

WELDING FOR THE CRAFTSMAN

POPULAR MECHANICS

**OCT.
25 CENTS**

SEE PAGE 573



"I want 30 cents
worth of light for
45 cents!"



*That's practically what you say when
you buy many a "BARGAIN" BULB*


Let's see what happens when somebody sells you a "bargain" lamp bulb. Let's burn this "bargain" in an electrical laboratory beside a genuine G-E MAZDA lamp. Let's suppose we burn both lamps a thousand hours at average current costs.

Here is an expert's report:

"Assume the price of a good lamp—such as a G-E MAZDA lamp—is 15¢ and the price of the so-called 'bargain' lamp is as low as 10¢. On the basis of the same amount of light for 1000 hours, for every dollar spent to burn the good lamp, it would be necessary

to spend over a dollar and a half to burn the inferior brand . . . or fifty per cent more.

"In fact there are 'bargain' lamps on the market today that you could not afford to burn even if you were given the lamps free and handed a one dollar bill with each one besides."

Here is an easy—and sure—way to identify a good lamp. Look for this mark  on every lamp you buy—for any purpose. It identifies a true bargain in light. General Electric Company, Nela Park, Cleveland, Ohio.



**GENERAL  ELECTRIC
MAZDA LAMPS**

It takes 25 operations

TO FINISH ONE FORD VALVE

EACH Ford valve requires twenty-five separate operations from the time work starts on a rough valve until it is ready for use. That is a surprising number of operations for such a simple looking part, but typical of the care used in the manufacture of all Genuine Ford Parts.

Ford valves are made in Northville, Michigan, in one of fourteen Ford single-department plants located within fifty miles of the plant in Dearborn.

The stems of the rough valves first receive two preliminary grinding operations. Then they go through a furnace where the heads are brought to a red heat. Next, automatic fingers place them in a huge machine where a ram strikes the red-hot heads, which refines the grain structure in the head, straightens it, and forms the valve seat.

Valves then pass through other grinding, machining and polishing operations.



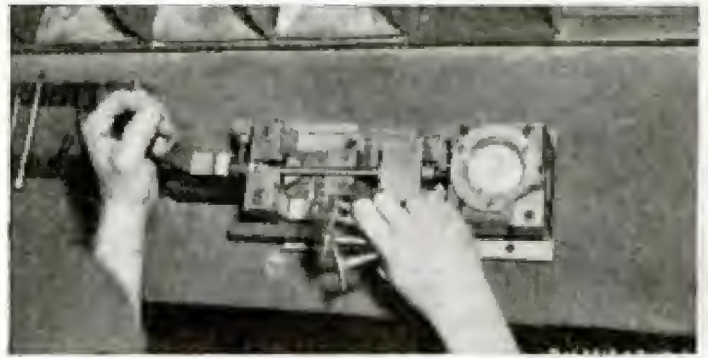
Each stem is ground five times for greater accuracy and smoothness. Inspection gauges keep a constant check on the precision machines.

In spite of this care, each Ford valve is subjected to most rigid final inspection. Amplifying gauges check the stem for roundness within two ten-thousandths of an inch. Similar gauges check diameter. Other inspection equipment indicates the slightest "run-out" of seat and checks stem end for squareness. Then the valves go into a constant temperature room where they are inspected for length.

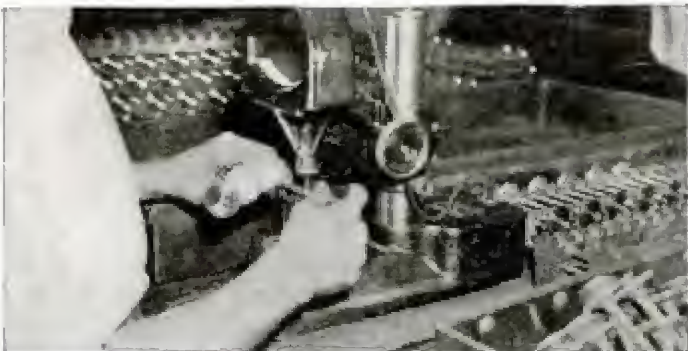
While the difference in length of a valve stem under normal temperature changes is very slight, measuring valves in a room where temperature is controlled indicates the precautions taken in manufacturing Ford parts. That is why it pays to get Genuine Ford Parts for your Ford car or truck.



A grinding room in the Ford valve plant in Northville, Michigan.



Length of valve is checked under same spring pressure as in engine.



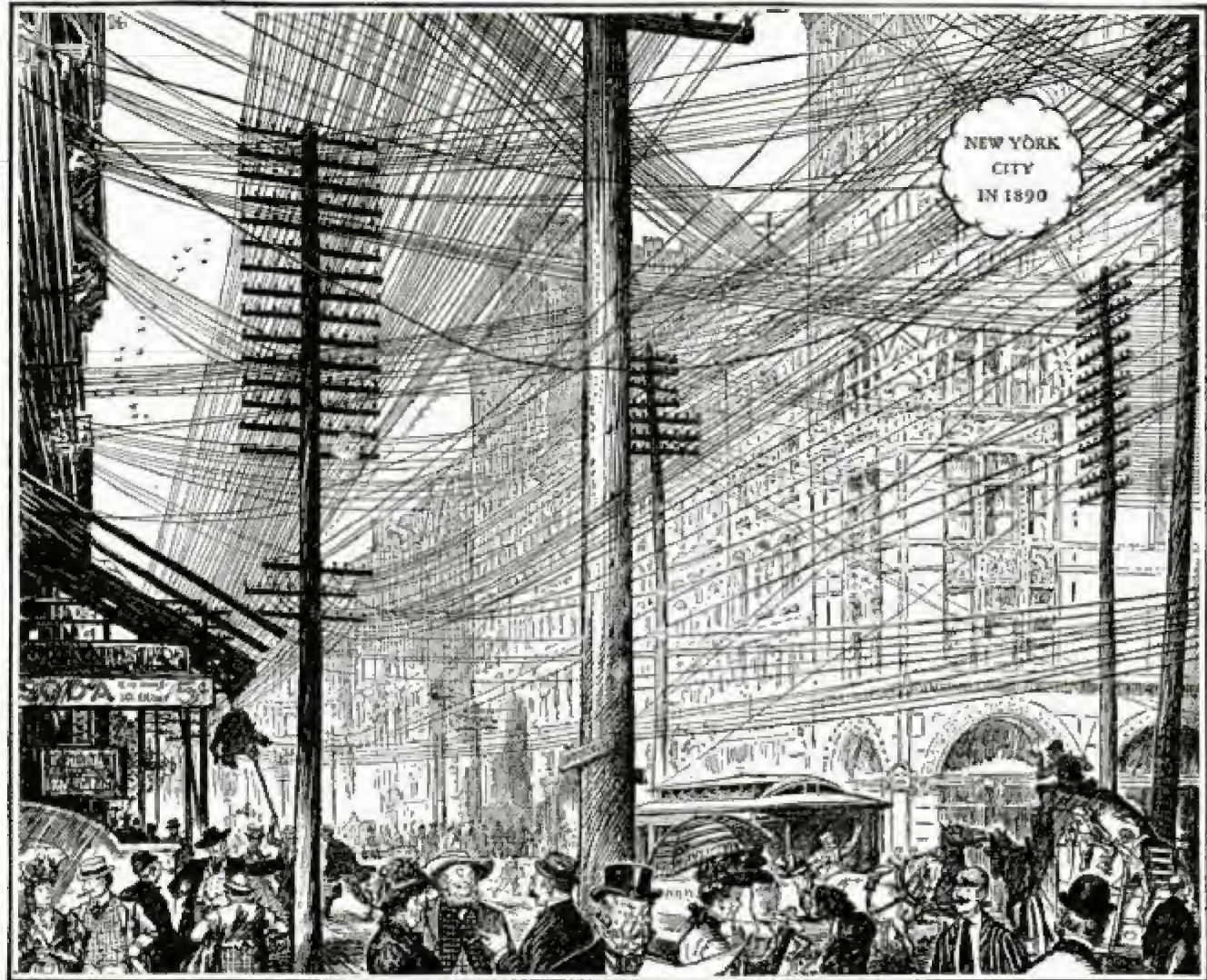
Optical and mechanical magnification gauges check valve stem diameter.



Rolling the Ford name on valve to protect you against substitution.

FORD MOTOR COMPANY • DEARBORN • MICHIGAN

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Years of Progress

HAVE BROUGHT MANY IMPROVEMENTS IN TELEPHONE SERVICE

BACK in the early days of the telephone, practically all wires were carried overhead on poles or on house-tops. Some of the tallest poles carried as many as thirty cross-arms and three hundred wires.

If the old system were in use today the streets of our larger cities would scarcely have room enough for their canopy of wires. Traffic would be impeded, telephone service subjected to the whims of nature.

Better ways had to be found and the Bell System

found those ways. As many as 1800 pairs of wires are now carried in a cable no larger than a baseball bat. Ninety-four per cent of the Bell System's 80,000,000 miles of wire is in cable; sixty-five per cent of it is beneath the ground.

This has meant a series of conquests of space, and insured greater clarity and dependability for every telephone user. But it is only one of many kinds of im-

provements that have been made.

The present generation does not remember the old days of the telephone.

Service is now so efficient that you accept it as a matter of course. It seems as if it must always have been so. Yet it would be far different today if it were not for the Bell System plan of centralized research, manufacture and administration—with localized operation.



BELL TELEPHONE SYSTEM

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Popular Mechanics Magazine

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October, 1935

Vol. 64, No. 4

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War Sentinels of the Pacific

STORM-WRACKED, befogged, a menace to shipping and a grim haven to the shipwrecked are the Aleutian Islands, nearly bridging the north Pacific ocean from Alaska to Asia. These little known volcanic islands, sometimes rising or sinking mysteriously into the sea, may one day be the site of an American "Gibraltar," a scouting and supply base for the air fleet defending our shores. From a hidden "aerie" in this thousand-mile archipelago planes could be dispatched to disperse any warships steaming to attack this country. An article next month, illustrated by eight pages of pictures in color, describes these islands of the north and the part they may play in defense strategy on the Pacific.

Next Month

THERE'S no end of fun in making a pack of cards do stunts. "Just choose any card in the deck," you tell the crowd at an evening party, and a moment later at your command the card fairly leaps out of the pack to dazzle and baffle your friends. With a little practice you can put over the tricks described in the next issue by Richard Cardini, master of card magic.

He's the Big Noise

COUNT G. Mazzaglia Cutelli can fake a noise that sounds more natural than the real thing. He rolls a walnut on a drum head and you'd swear the Graf Zeppelin was overhead. He bounces a basket-ball bladder with buckshot inside it and you imagine a munitions factory just blew up. An article in the November issue reveals some secrets of this great "sound-maker" for radio studios.

"Down Flaps!"

SIT down in the pilot's seat of a giant transport and take the ship over its route, from the warm-up at the hangar to the "Down flaps!" order that brakes her speed to fifty-eight miles an hour as she touches earth after a 200-mile-an-hour flight. You're partner to a transport pilot in the nose of an airliner in an article next month.

Published monthly by POPULAR MECHANICS CO., 200 East Ontario Street, Chicago, U. S. A. Single copy in United States, 25 cents; \$2.50 a year, \$4.00 for two years in United States and possessions, and countries of the Pan American Postal Union; for Canada, Newfoundland and Labrador, add 50 cents a year extra for postage; to all other countries add \$1.00 a year extra for postage. Changes in address must be reported to us immediately to eliminate delay. Entered as Second Class Matter, Sept. 15, 1903, at the Post Office at Chicago, Illinois, under Act of March 3, 1879. Entered as Second Class Matter at the Post Office Department, Canada. Copyright, 1935, by Popular Mechanics Co. in the United States, Australia and France.

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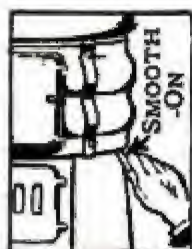
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Quick, easy, dependable ways to make over 100 of the commonest emergency and routine household repairs are explained in this free booklet.



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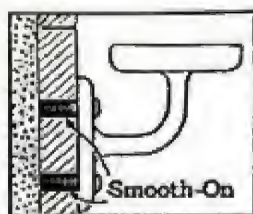
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Are you, too, up against life's big question— "How Can I Make More Money?"

Every bill to be paid, every need to be met, every dream still unfulfilled—demands the answer to this question. For on its answer hang all the other answers of life: how you live, what you wear, where you go, what you do, the position you hold, the one you hope to hold in future!...

MORE than anywhere else, this question haunts you daily on the job. You want a bigger salary; more pleasant and interesting work to do; more advantages for your loved ones—recreation, travel, social activities. And so, as you keep plodding on, in between the little thoughts comes this big one, again and again: "How can I make more money?"

Well, how can you? . . . By working harder than ever, so as to attract more attention to your industry? Thousands of people are working harder than ever, these days; employers have no worries on that score. By trying to "get a stand-in" with somebody of influence? Plenty of people have tried that, too—only to fall down because they couldn't deliver. By getting "outside work" to do? Sooner or later, your regular job suffers—and then what?

Out of the corner of your eye you can see a long line of folks just waiting for the job you have now. Any time you're "out," a dozen others are ready to step in. So it's dangerous to resign and look elsewhere, isn't it? Besides, jobs in your same line elsewhere are bound to pay about what you're earning now.

What's Wrong, Anyhow?

Let's be quite serious for a moment about this "money" question. Who, as you glance around the business world, are the money-makers in it? Are they the filing clerks, typists, stenographers, bookkeepers, timekeepers and routine clerical people? Or are they the expert salesmen, the accountants and C. P. A.'s, the attorneys, the traffic managers, the personnel directors, the sales correspondents, the sales managers, and other executives who give orders for other people to execute?

And how did these money-makers, with their enviable jobs and opportunities, "get that way"? Was it simply by working hard—having a "pull"—changing jobs till they found the fat salaries they wanted?

Experience says no! . . . They make more money than the rank-and-file in business for just one reason: they

have *trained* for the better-paid specialized functions that Tom, Dick and Harry, the rank-and-file, cannot discharge.

Their Answer is Yours

That is their answer to life's biggest question. It is *your* answer as well. And LaSalle Extension University has made it possible for YOU—granted a real purpose and adequate education—to train for the field in which you would prefer to earn more money. Without leaving your job, you can do what more than 800,000 men and women have done already: utilize your spare time for home study that definitely equips you to get your money question *answered*.

The coupon below lists a number of specialized vocations which today offer the interesting work, attractive opportunities, gratifying incomes—all the rewards that go with "bigger responsibilities." Pick out the one that most appeals to you, check it, and add your name and address. Find out the interesting facts about it which your inquiry will bring you promptly, without obligation. Send your request along NOW, and learn how to get the one right answer to this biggest of life's questions—the question of "more money."

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YOU CAN REPEAT ALMOST EVERY EXPERIENCE IN LIFE

— EXCEPT

life - itself



TODAY is life. Tomorrow is a hope. Yesterday is a dream. Nothing is so dead as a day that has passed. Only the trailing clouds of memory remain.

One *today* upon another *today*—how quickly a decade is built! Youth approaches manhood in high heart, embraces maturity as the period of his conquest, then “remembers with a sigh the days that are no more.”

So life goes—like that. NOW is the only opportunity. NOW is the moment of success. NOW men decide—NOW men win or fail.

Are you one of the men who are wondering today what will happen to them tomorrow? Then

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Copy this girl and send us your drawing—perhaps you'll win a **COMPLETE FEDERAL COURSE FREE!** This contest is for amateurs, so if you like to draw do not hesitate to enter.

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RULES FOR CONTESTANTS

This contest open only to amateurs, 16 years old or more. Professional commercial artists and Federal students are not eligible.

1. Make drawing of girl 5 inches high, on paper 6½ inches square. Draw only the girl, not the lettering.
2. Use only pencil or pen.
3. No drawings will be returned.
4. Write your name, address, age and occupation on back of drawing.
5. All drawings must be received in Minneapolis by Sept. 25th, 1935. Prizes will be awarded for drawings best in proportion and neatness by Federal Schools Faculty.

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GUESS I HAVEN'T A RIGHT TO ASK A GIRL LIKE MARY TO MARRY AN ORDINARY MECHANIC.

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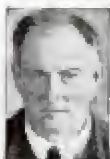


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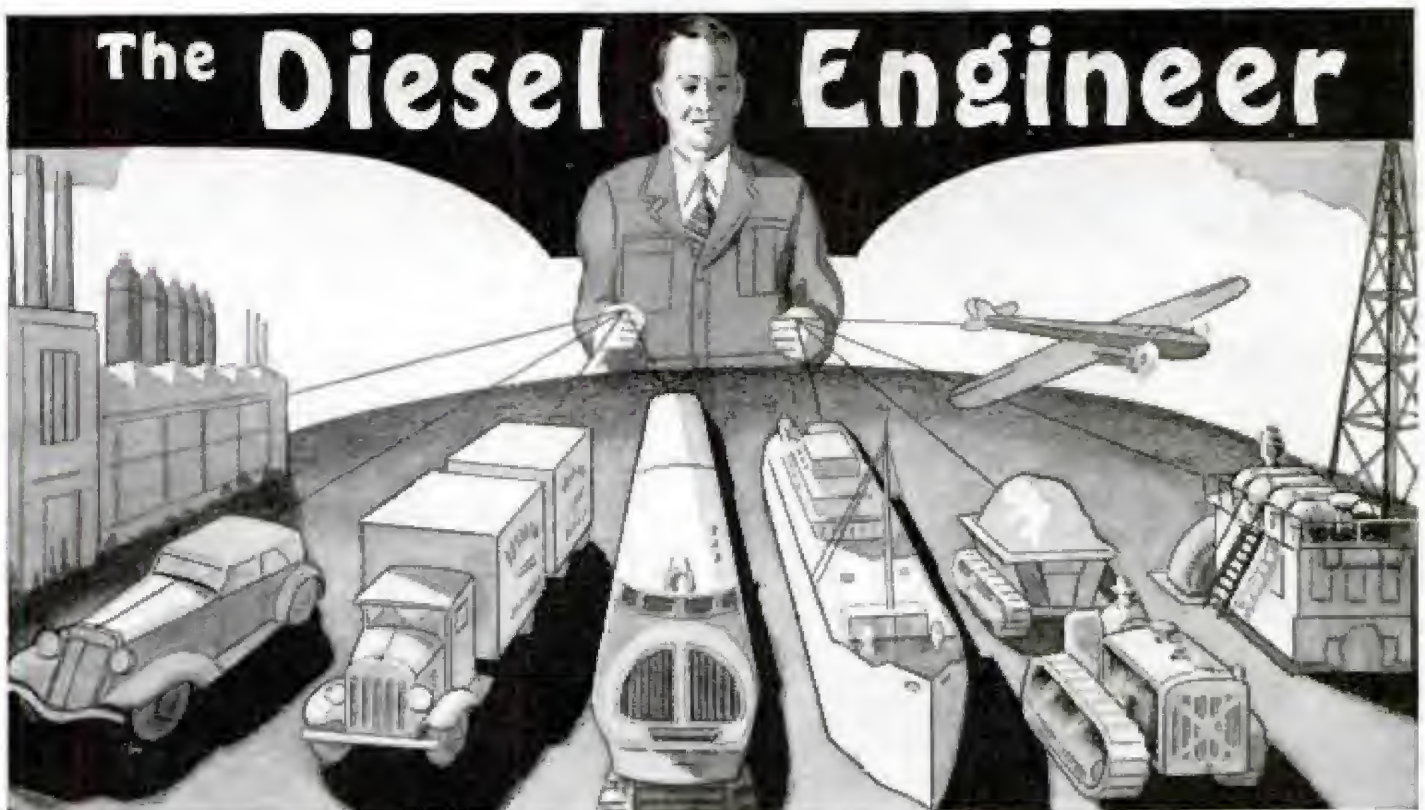
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Pulls in EAQ



"I have built the two-tube S.W. receiver described in the January issue of 1934. It brings in the U. S. and Canadian stations very clearly and I have heard several South American and European sta-

(Continued to page 22A)



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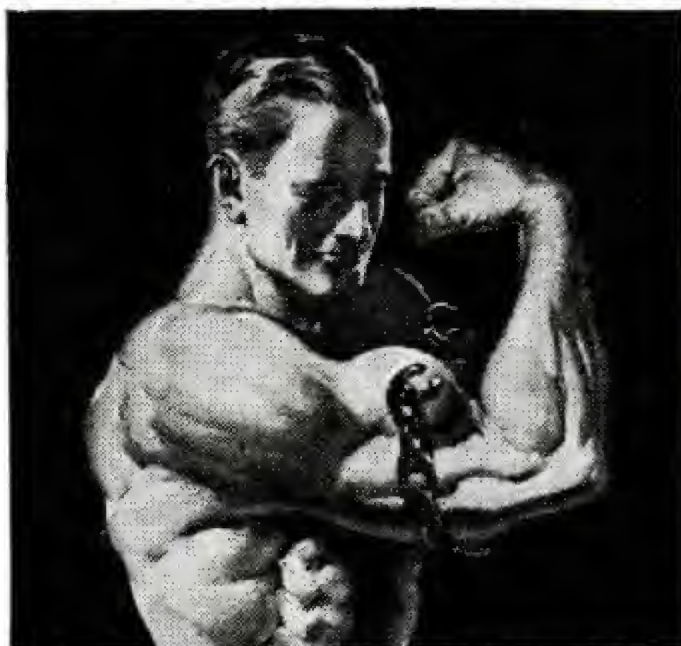
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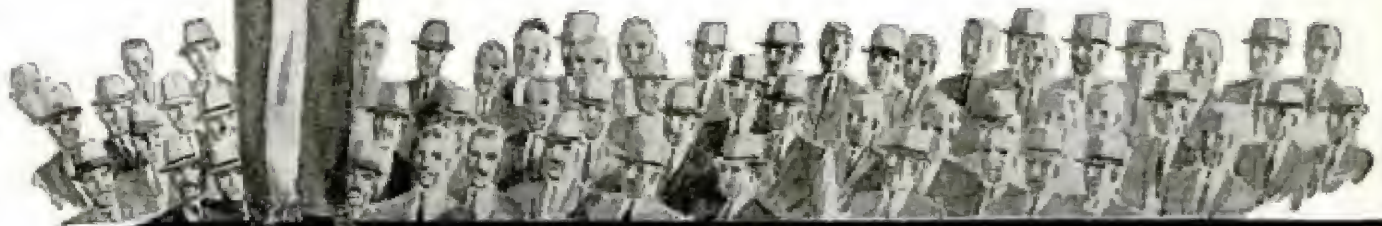
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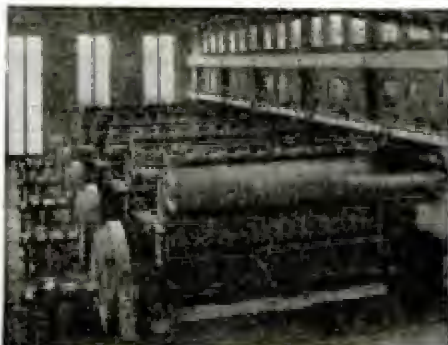
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At right—the five huge M.A.N. type DIESEL engines at the Vernon, Calif. plant, with total of 35,000 horsepower. Many HEMPHILL Graduates are occupying important Diesel positions throughout the United States and foreign countries.



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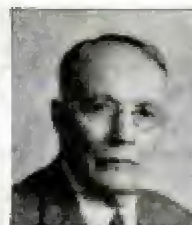
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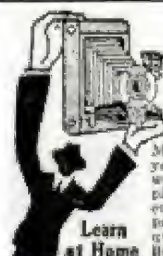
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WELL, I SEE YOU REALLY ARE TAKING UP TAXIDERMISTRY IN EARNEST, BILL.

THAT'S RIGHT, JIM—AND I'VE NEVER HAD SO MUCH FUN IN MY LIFE. I'VE ACTUALLY DOUBLED THE PLEASURE I GET FROM MY HUNTING AND REALLY HAVE SOMETHING TO SHOW FOR IT.

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BUT WASN'T TAXIDERMISTRY HARD TO LEARN, BILL?



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I'll help you get into this line—RIGHT

I'll give you the finest course in Diesel Engineering that money can buy, at a price that makes it the most profitable investment a fellow can make. Please don't feel that because the opportunities are almost endless in Diesel that you can get along with a cheap smattering of Diesel knowledge. Diesel wants men who *know how* and is willing to pay handsomely. If you are the clear headed fellow I think you are you'll want the SUPERIOR TRAINING

my school can give you. You will be mightily interested in my 26-year-old reputation for making a high percentage of successes out of my graduates—you'll be interested in the fact that there is no better equipped

Diesel school in the country—and in the fact that if you elect to come to the Adcox School I will help you finance your training period if you wish by helping you get a part time job to pay your room and board. I will help you all through your schooling backed by the friendliest, most capable staff you ever met.

\$300.00 JOBS



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Jerry wrote me recently: "My investment in time and money in the L. L. Adcox Trade School was returned to me in the first three months after my graduation. My position as Chief Diesel Engineer pays me \$300.00 per month."

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Read *How to Choose a Diesel School* in my new valuable Diesel Book No. 18B. Write today for your FREE copy and make up your mind to start on a career of financial success, independence and happiness. Use this Coupon NOW.

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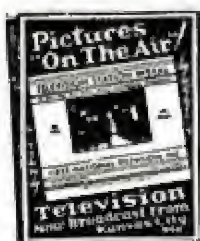
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The Editor's
MAIL BAG

(Continued from page 14a)

tions. EAQ, Madrid, Spain, comes in very good about 5:00 p.m. eastern standard time."—Robert Welsh, Oil City, Pa.

A Real Builder



One of Mr. Hausmann's Models

"I am sending you a snapshot of one of the models in my collection. I began working on models about twenty years ago as a pastime and have completed three trains, besides the 'De Witt Clinton' built from your plans, several narrow-gauge locomotives and many ships."—George G. Hausmann, Albany, N. Y.

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(Continued to page 54A)

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Exciting World-Wide Entertainment... Glorious New Acousti-Tone
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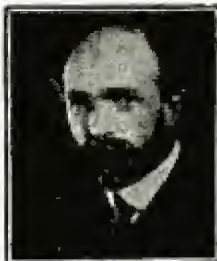
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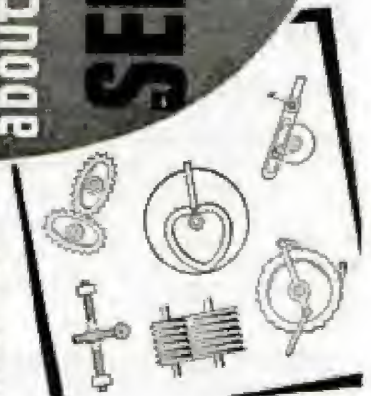
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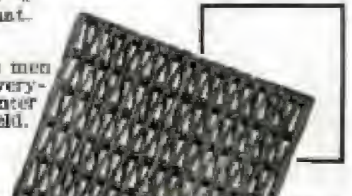
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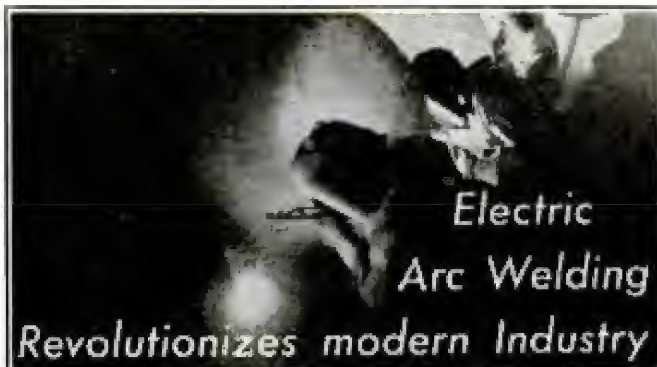
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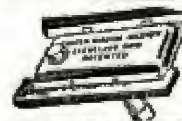
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A BIG Opportunity for men acquainted in daily, ice cream, bakery, laundry, restaurant, beer garden, road stands and green house trade with a new product with unusual merit. Easy sales. Quick money. Electric Screen Products Corp., Dept. PM-5, Dubois and Clay Aves., Detroit, Mich.

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POPCORN, Crispette, caramelsisp, potato chip, salted nut machines. Long Nakins, 1902 High St., Springfield, Ohio.

PERMANENT Connection in protected territory representing one of largest fire equipment manufacturers in United States selling municipalities, industrials and residences. All Underwriters' Laboratories approved equipment. Real financial opportunity. Absolutely no investment required. The General Fire Truck Corp., 4131 Forest Park Blvd., St. Louis, Mo.

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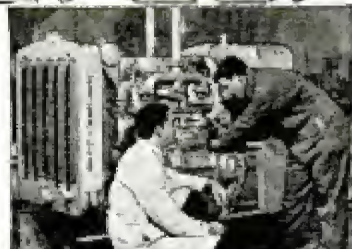
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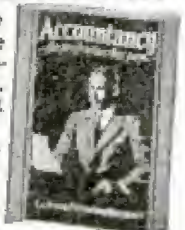
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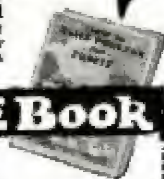
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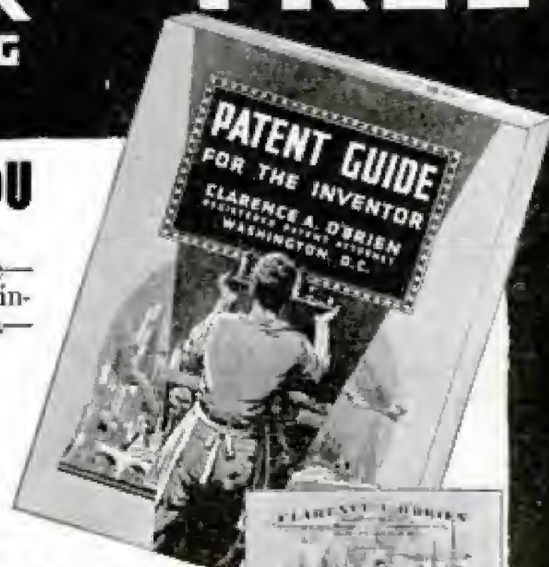
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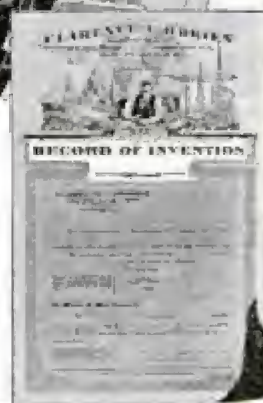
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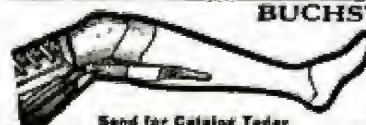
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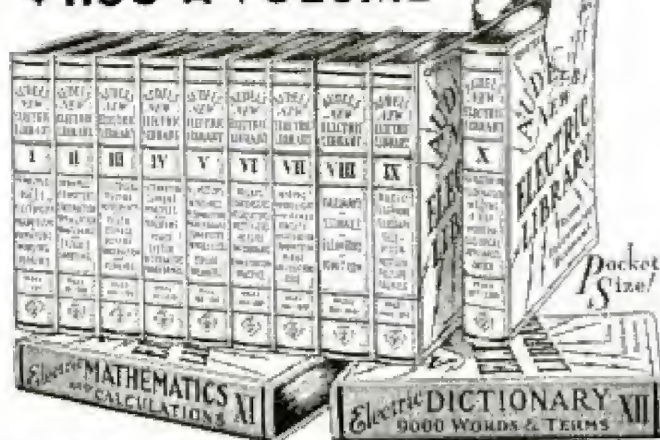
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The Editor's MAIL BAG

(Continued from page 22A)

such a fine article."—*Jose Calderon Miro*, Rio Piedras, Puerto Rico.

From Your Blueprints



Edward Cox with Clock and Chair

"Here is my son, Edward, Jr., age 18, with a lawn chair and a grandfather clock he made from your blueprints and plans."
—*Wm. E. Cox*, Southern Pines, N. C.

Match-Stick Models

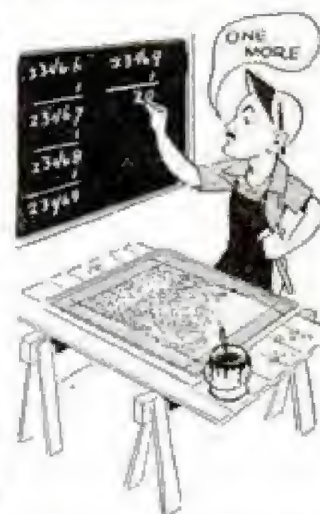


"Here is my ship model which is constructed of 10,000 match sticks and glue. It is about twenty-seven inches long. Searchlight, run-

ning lights and cabin lights all burn. I am now building a model galleon of match sticks."—*Carl Kramer*, Port Arthur, Tex.

An Inlay Craftsman

"I have completed a table of inlay work. It has 12,316 pieces of wood in the top, rails and legs. In this construction, 205 different kinds of wood were used. Another table now under construction will have 350 different kinds of wood and the top will have more than 25,000 pieces and the total number of pieces will be more than 30,000."—*M. M. Davis*, Jackson, Tenn.



Father-and-Son Boat

"This is a picture of the boat I built from plans published in your 1930 issues which my son had saved for four years.



Built from Popular Mechanics Plans

When it was completed, I felt very satisfied. It is a beauty and seaworthy."—*Edw. N. Brough*, St. Johnsbury, Vt.

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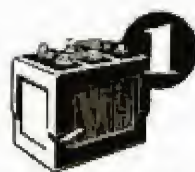
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(P. M. 10-35)

Timely Tips FOR FALL AND WINTER DRIVING

6 simple things to do now to save cold weather trouble and expense



1 KEEP YOUR BATTERY AT ITS BEST

Many a motorist unknowingly runs his car all summer on a battery with a weak or dead cell, then wonders why he has starting trouble the minute a cold wave comes to town. Even a fully charged battery operates only at about 50% efficiency in zero weather. In addition, your battery gets heavier starting loads and lights are burned longer. Have your battery checked **now**! Not the usual quick inspection. Be sure a volt meter reading is taken on each cell. Finally—keep your eye on your battery and you'll keep your car out of trouble.



2 CHEAP IGNITION INSURANCE

It will cost you mighty little and save you a heap of grief to have your ignition system and electric wiring checked for leaks and short circuits. Most important, have your spark plugs cleaned and adjusted. Hot summer driving has probably increased the gap between the spark plug points. Have them reset to 25 thousandths of an inch for best cold weather results.



3 INCREASE THE GENERATOR CHARGE

The best way to offset the heavy battery drain that is sure to come with cold weather starting and lighting is to increase the charging rate of the generator. This is achieved by resetting the third brush. If your car is radio equipped your generator charge should be boosted to the maximum and radio listening cut to the minimum.



4 RADIATOR PRECAUTIONS

It's none too early for most motorists, especially those in the Northern States, to guard against a sudden drop in the thermometer. A half-charge of a good anti-freeze is your best insurance against unexpected zero weather. Before adding the anti-freeze have your radiator flushed and all hose connections tightened.

5

USE LIGHTER TRANSMISSION AND DIFFERENTIAL LUBRICANTS

The best time to change your transmission and differential lubricants is in the Fall. First: you get fresh, clean lubrication which is vital after a summer season of heavy driving. Second: you get lighter lubricants which are a material aid in facilitating cold weather starting.



After your old worn out lubricants are removed from the transmission and differential housings, make sure kerosene oil is used to flush out all grit and metal grindings. But remember this: Because winter gear lubricants are lighter in body, they must be higher in quality to meet the extra cold weather driving demands. Play safe! Use the new **Veedol Gear Lubricants**.

Your dealer has them and he applies them according to the manufacturer's directions in the 1935 **Veedol Lubrication Guide**.



6 CHANGE TO COLD-PROOF, HEAT-PROOF MOTOR OIL

Nearly every motorist realizes that his car demands a lighter motor oil in cold weather. But few motorists know that winter motor oil must not only be cold-proof but heat-proof. It isn't enough that an oil flows freely at zero temperatures. It still must hold its body and lubricate fully after the motor is warmed up. That's why it will pay you to insist on **Winter Veedol**—the oil that is both cold-proof and heat-proof—the only motor oil used by Admiral Byrd in both of his famous Antarctic Expeditions.

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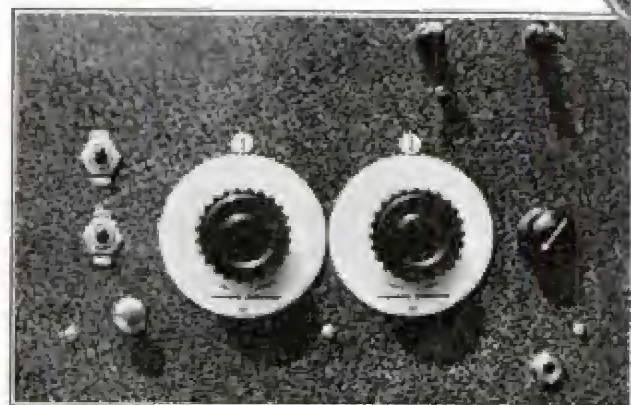
OCTOBER, 1935

No. 4

The CONQUEST of STATIC

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Amateur interest in high-frequency radio reception is heightened by the fact that three stations in Boston, Pittsburgh and Philadelphia already use the ultra-short waves, and full



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entertainment programs are available for sets capable of tuning in on the 55.5 megacycle frequency of Station W3XKA, Philadelphia. Other stations

are to be built, for the ultra-high frequencies are a step on the road to television and the cost of building and operating such transmitters is relatively low.

Receiving sets, too, are quite simple and comparatively inexpensive to make, and there are plans developing to incorporate receivers for the ultra-high frequencies in new "all-wave sets." This would not be an adaptation, but a complete set would be added to present equipment, using the loudspeaker and power supply of the regular set. Admittedly there are "dead

Cont. George H. Eckhardt
2047 N. Park Ave

E 807
cable.
any length. 75 cents per foot
Mr. Haigis Philadelphia
Wholesale Trade. U.S.

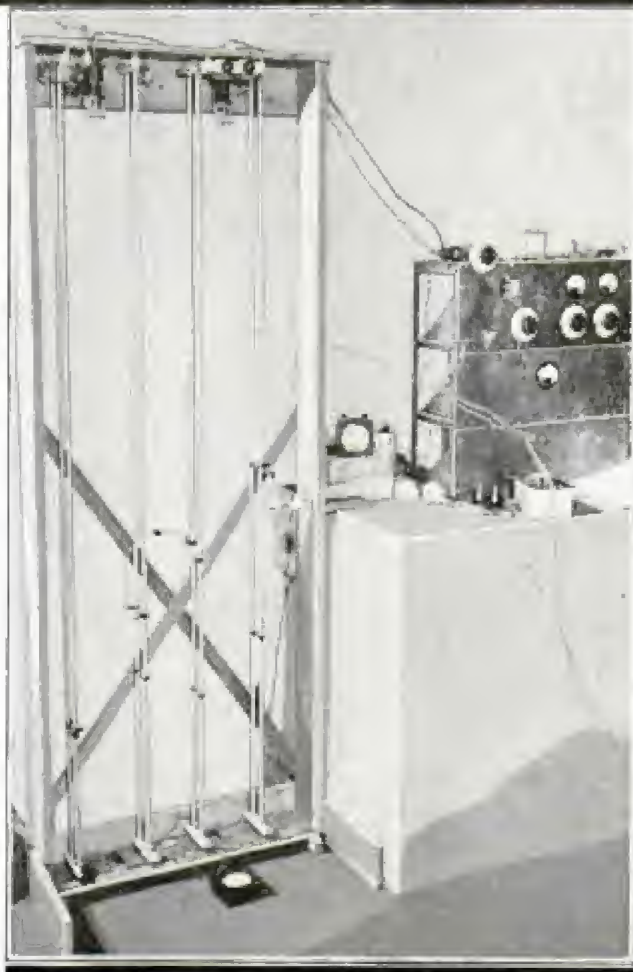


Directional Antenna of Ultra-High Frequency Radio Transmitting Laboratory; Rods Are Used for Aerial, Which Has Been Lowered for Purpose of Picture; with This Arrangement of Rods Both Sending and Receiving Range Can Be Increased Greatly

spots" in the ultra-high frequencies, but they are small and can be avoided by moving the aerial, sometimes only two or three feet. Another disadvantage has been interference from automobiles. This is overcome by moving the receiving antenna at least seventy-five feet back from heavily traveled highways, or by stepping up station power.

It has been definitely established that around 55.5 megacycles, static from weather does not exist. A megacycle is a thousand kilocycles or a million cycles. Ordinary alternating current operates at sixty cycles per second, or sixty oscillations per second. Oscillator tubes, part of the transmission apparatus, control radio frequencies. A station broadcasting on 1,000 kilocycles, one megacycle, has a wavelength of 300 meters. Standard broadcasting stations send on waves between 200 and 550 meters long. If the frequency is raised to from forty to 100 megacycles, the "ultra-high" range, the wavelengths are seven to three meters.

The big disadvantage of these ultra-high frequencies has been the limited range of transmission—twenty-five to thirty miles from the station. But this is offset to some degree by the low cost of building—many



Transmitting Apparatus of Ultra-High Frequency Station Using Only 100 Watts; Note Simplicity of Its Construction

high-frequency stations can be erected for the investment outlay of one ordinary broadcasting station. Power cost is also small, 100 watts usually sufficing to overcome automobile interference; in England ten kilowatts proved ample for both sound and television. Located in neighboring cities, ultra-high frequency transmitters do not interfere with each other even on the same wavelength with conflicting programs. Because of its fidelity, it may prove to be the ideal type of sound transmission for city areas.

Receiving outfits including an ultra-high frequency set would anticipate television so far as sound reception is concerned. Such a set would be ready to receive the sound part of a television broadcast, although it would require other equipment to bring in the picture.

WRENCH IS EASILY ADJUSTED BY PRESSING THUMB ON CAM

Pressure of the thumb on a cam is all that is necessary to adjust the jaws of a screwless wrench now being manufactured. The adjusting screw, often loose and refractory, is eliminated. Movement



of the cam in one direction closes the jaws with strong pressure; rotating in the opposite direction it allows the jaws to open under pressure of a coil spring inclosed in the stock. It is a one-hand tool, and has been specially designed for rapid and precise action.

Buriston Spanner

Flying Fort Carries Cannon £846. and Four Machine Guns



Winged Arsenal Which Carries a Cannon and Four Machine Guns; It Speeds 250 Miles an Hour in Pursuit of Foes

Speeding four miles per minute, a combat plane constructed in England carries a cannon and four machine guns. This winged arsenal is a single-seater biplane. A machine gun is carried in each lower wing and two are mounted on top of the fuselage. All are fired through the propeller. Each gun carries 300 rounds of ammunition. The cannon lies between the cylinder blocks of the ship's 860-horsepower engine and fires forward through the hub of the airscrew. Hidden almost from view in the center of the plane, the pilot awaits the appearance of an enemy squadron. The landing gear and wheels are sheathed, giving the plane's lower extremities the appearance of the legs and claws of a great bird.

WAXING KEEPS MELONS FRESH

Cantaloupe picked dead ripe may be received by consumers thousands of miles away in the same condition they came from the vines by the introduction of a waxing process developed by a California company. Coated with a thin layer of wax, the fully matured fruit by proper refrigeration can be kept edible for five weeks.

installed in
Rackman's

Handwritten notes:
Hautonne
Wider Works
for Belgium
Fairley Aviation Co
Middlesbrough
Hayes
Built by
Food Machinery
Corp., San Jose, Calif.

Orley-Watford England

Safety Leap to Life Net Caught by 'Magic Eye'

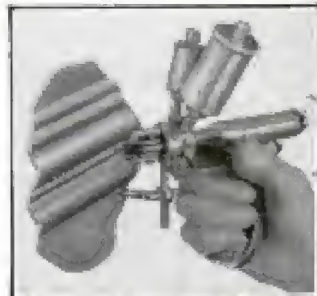


Down He Comes, a Daring Fireman Demonstrating How Leap from Burning Building into Net Should Be Made; Ultra-Fast Camera Caught It

How to leap safely from a burning building into a life net was demonstrated recently by Leroy R. Greenhaw of the Los Angeles fire department. With a "magic eye" camera, which records action swiftly, trained on him, the fireman jumped from the top of an eighty-five foot drill tower into a net held by his comrades. The camera caught him right at the start, leaping in standing position. But as he neared the net, he drew up his legs gradually until he was in sitting position when he landed.

STRIPER PAINTS SIX LINES IN DIFFERENT COLORS

Gripped in the hand like a pistol, an adjustable multi-color striper can apply two, four or six lines, each of a different color, to any surface simultaneously. A trigger-like lever pressed by the thumb controls its operation. Color cups are ranged fan-wise around the handle and adjustable screws regulate the flow of paint to the striping nibs, two of which slide back and forth to fit the contour of the surface being striped. A revolving guide is suitable for use in any position.



SAFETY BOX LIKE BIG PADLOCK CAN BE FASTENED ANYWHERE

Handy protection for the traveler's valuables is offered by a portable safety box, with a lock which is attachable to bedposts, chairs, steering wheels or any other stationary object around which the hasp will fit. The safe, which resembles a mammoth lock, is a roomy two-section steel telescope case. The sections are automatically sealed together when the lock is closed.



Ralph Hobbs.

New York, N.Y.

Slopes of Norris Dam Rising to Tame a River



Norris Dam, about Two-Thirds Complete on the Clinch River Thirty Miles from Knoxville, Tenn.; This Shows Penstock Openings at the Spot Where Power House Will Be Built

SIMPLE LOCK FOR AUTO TAG GUARDS AGAINST THEFT



Top, Anti-Theft Plate Assembled; Bottom, Parts That Lock the Plate on Bracket

Simple and inexpensive, an anti-theft locking device has been devised for automobile license plates. It consists of two bolts for mounting the plate in the usual manner and two locking buttons. Once in place, the buttons and bolts cannot be removed without destruction and without marring the face of the plate. The inventor hopes to obtain cooperation of state vehicle license departments in manufacturing the lock buttons so the name of the state will appear on one button, the year on the other.

LIGHT STEAM BOILER IS RIVAL OF DIESEL IN EFFICIENCY

Highly compact and light in weight, a steam boiler has been developed which rivals the Diesel in power efficiency and is especially adapted to use in locomotives and the narrow hulls of submarines, destroyers and other war vessels. The steam generator weighs only one-fifth as much as the ordinary oil-fired water-tube boiler

and occupies only one-half the space of the usual marine boiler. When the boiler is forced to full steam output an efficiency of eighty-eight to ninety per cent is obtained compared with seventy-five per cent in the standard marine steam plant. It can be brought from cold to full steam generating capacity in four to eight minutes, and changes in load are quickly handled. Air and fuel, any type of fuel oil can be used, are blown into the combustion chamber at more than 1,200 feet per second, faster than sound travels. The boiler develops 600 pounds pressure to the square inch. Ability to heat and cool rapidly, and invisibility of exhaust gases make the new type boiler advantageous for use in submarines.

FIBER FOR PACIFYING CANARY STOPS FEATHER PULLING

Hung in the cage to keep the birds from pulling feathers and overeating, fiber tassels are offered to pacify canaries. The tassel, made of sterilized Mexican pearl fiber, is treated to prevent the breeding of mites. Should the canary eat the fiber, there is no danger of harming the bird.



Fiber Tufts Are Shown Attached to Cage on Level with the Canary's Head

Described in
"Mechanical
Engineering"

George H. Layton Co
7270 W. 69th St.
Chicago, Ill.

Model Plane Built to Scale from Photographs

Constructed of odds and ends with simple tools, a scale model of a Pan American clipper plane is complete to radio antenna and lighted cabin. Fred J. Haase of Chicago built the small transport from photographs of the giant clipper in Popular Mechanics Magazine, on a scale of about one-fourth inch. Materials in the plane include balsa wood, pins,



Top, the Builder Working on Model Clipper; Bottom, the Midget Craft, Complete to Lighted Cabin; Wings Are Ridged Like Those of Original Plane; the Model Was Made from Photographs

toothpicks, guitar string, cardboard, typewriter paper, Cellophane from cigarette packages, isinglass, fish cord and bell wire. Tools used in the construction were tweezers, pliers, knife, scissors, rule, pencil, compass and sandpaper. A round jar top could be substituted for the compass. Toy

auto light bulbs and a flashlight battery enable the builder to light the cabin by flipping a switch. The model is well-balanced, floating exactly at the water-line when tested in large basin. Materials for the ship cost less than \$8.00, and the builder spent about eight weeks on the model.

Electric-Bell Signal on Car Used as Substitute for Horn

Intended to replace the horn, an electric-bell signal for automobiles has been produced in England. Horns have been outlawed in London and noise-abatement campaigns are starting in New York and other cities, attention being directed particularly to the blowing of raucous horns at night. A bell would provide the means for warning pedestrians and other drivers. The signal, which has chime-like tones, is housed in a waterproof metal case. Pressure on the usual horn button on the steering wheel will operate the bell.



Bell Signal between the Headlamps Is Tested as a Substitute for Noisy Horn

Edwards & Co., 140 N. St.
and Exterior Ave. Wash.

Plane Without a Tail Is Designed for Safety

Waldo D. Waterman
Santa Monica, Calif.



The "Arrowplane" in Flight (Top) and on the Ground; Note Space in the Cabin

veloped to such an extent that much of the skill ordinarily required for piloting is not essential. The seat accommodates pilot and passenger. The designer, Waldo D. Waterman, expects the ship to sell at less than present planes of the same size.

WEATHER GAUGE FOR DESK TELLS TEMPERATURE AND HUMIDITY

Easy to take off, fly and land, the latest "flivver" plane built for experimental work by the bureau of air commerce has no tail. Instead, it resembles an arrow. A ninety-five horsepower motor, located at the rear of the cabin, gives the small craft a top speed of 110 miles per hour and a cruising speed of ninety-five miles per hour. It takes off and lands at about forty miles per hour. Its twenty-six gallon tank holds fuel for 350 miles. A special device which makes it almost impossible to stall the plane completely or make it spin can be installed, but even without this safety feature, it has been found impossible to hold the ship in a spin, no matter how the controls are handled, the maximum being two turns. Simplicity of handling has been de-

Hung on the wall like a calendar or placed on the desk, a small combination thermometer and humidity guide tells at a glance the temperature and relative humidity. A horizontal dial across the top records the humidity. The thermometer runs vertically up the side. The instrument is three and three-eighths inches wide, four and five-eighths inches high and seven-eighths of an inch deep. It has a standing easel that folds back to permit hanging anywhere.



Reliance Lye & Stamping Co.
1245 Clark St. Chicago

Photos from the World of International

The LATEST for the CRAFTSMAN

New Fields Opened In
The Fascinating Art of
Metal Working and Welding

Now Available
for Everyone

SOME of the hundreds of articles the home craftsman can make with a simple sheet metal-working outfit, and rolling the side for a wastebasket in the shaping machine, one of four units in the outfit.





LEFT, operating the compact air-cooled spot welder which makes semi-continuous welds in metal one-twentieth of an inch in thickness or lighter, and, at right, punching holes with the aid of one of the attachments on the shaping machine.

For prices see 130 a *Discontinued*
By H. W. MAGEE 10/18/37

TAKE a sheet of cardboard, a pair of scissors, a pot of glue and a can of paint. Cut out a design for a wastebasket. Glue the edges together, paste the bottom to the sides and paint it inside and out. Not much of a task, is it? The trouble is that it's not much of a basket either.

But suppose you had used sheet metal instead of the cardboard and could have done the job almost as easily and quickly. You would have had a substantial metal basket instead of a flimsy cardboard one. That's the opportunity open to home craftsmen today.

With the aid of a new portable metal-working outfit, you can make articles of sheet metal almost as easily as though you were working with cardboard. You can cut, bend, weld and paint the pieces going into a wastebasket, for instance, in less than half an hour and at a cost of less than twenty cents.

To realize the possibilities, simply look around your home, shop or office and jot down the innumerable articles made of sheet metal or in which sheet metal can be substituted for other materials. You'll find trays, stands, baskets, chairs, stools, racks, shelves, bric-a-brac, tables, lamps, radiator covers, fire screens, window screens, soap holders, bird cages, lawn ornaments, lunch boxes, ice boxes—almost an endless list.

With the metal-working equipment, making these and literally hundreds of other useful articles becomes an easy matter requiring neither special skill nor technical training. It's just a matter of substituting the sheet metal for your cardboard, a motorized jig shear for the scissors, a metal shaper for your hands in bending the parts, a portable electric welder for the glue and a portable sprayer for the can of paint and brush.

Sheet metal working, of course, is not

Suggest Magna Machine and Tool Works

*Belasco Bros. Mfg. Co.
Muncie, Ind.*



ROLLING a piece of metal to form a cylinder in the shaping machine and, at top, using the motor-driven jig shear which cuts sheet metal like butter, and bending a small section to form the side for an ash tray.



CUTTING out a metal cat on the jig shear as the first step in making a lawn ornament. The shear is operated by a one-fourth horsepower motor.

new, but it has always offered difficulties for the home craftsman. Usually it has meant tedious hours with tin snips, soldering irons and other hand tools with unsatisfactory results often rewarding days of effort. This new sheet metal-working outfit applies to the home workshop on a miniature scale the same methods used by the factory and opens to the home craftsman all the advantages of sheet metal as a material plus an ease of handling and assembling heretofore unknown. It offers not only an interesting and absorbing hobby with a very practical application, but a chance to make money by converting the hobby into a business.

It all started when C. A. Frick of Muncie, Ind., visited the shop of a friend and found a queer metal contraption standing on a bench.

"Looks like a baby welder," Mr. Frick observed.

"You guessed it," replied his friend. "It's a plaything. Want to try it?"

Mr. Frick did. He took it home, set it up on the kitchen table and he and his son went to work. They welded handles on pots and pans in the kitchen, they made crude baskets and pieces of bric-a-brac. But they had their troubles. The welder over-heated and each weld threatened to be its last. Mr. Frick decided to build a spot welder of his own and the one he produced is one of the four complementary units of the sheet metal-working outfit.

This welder is air-cooled, of the two-heat type, can be operated from any house supply of alternating current with the use of appropriate fuses, is virtually silent in operation, has a foot-tread control and can be used with metal one-twentieth of an inch in thickness or lighter. It makes semi-continuous welds of all sheet metal or wire offering resistance to the passage of electric current, and two pieces of metal can be welded securely simply by placing them together and bringing the points in con-



USING the shaper, above, to curve the side in making a metal wastebasket. Attachments for the shaper are supplied for rolling and beading flat sheets, crimping and flanging, punching and all other operations in forming. Right, using the spot welder which is operated by ordinary house current of the alternating type.





tact with the metal repeatedly by operating the foot tread.

When he had developed a satisfactory welder, Mr. Friek began thinking about cutting and shaping sheet metal. He remembered the kinks and wrinkles which usually resulted when he operated tinners' snips. So he decided to build a small and compact power shear to do this unwieldy job. The result was the second unit of the metal-working outfit—a jig shear driven by a one-fourth horsepower motor. This shear cuts metal like butter. It has only a one-sixteenth inch stroke which makes it safe and will cut twelve to fifteen feet per minute in straight slits, circles, curves or irregular designs. Inside cuts can be made by a vertical adjustment of the high-speed steel blades.

For shaping the sheet metal, he developed a hand-operated former capable



THREE of the four units of the metal-working outfit are shown above—the paint sprayer, the spot welder and the metal shaper. The fourth is the jig shear which is illustrated elsewhere. Below, using special forms on the shaper for making bends,



A FEW of the many articles made with the metal-working outfit are shown at the top. The wastebasket in the center can be made with the aid of the outfit in less than half an hour and at a total cost, including finishing and decorating, of less than twenty cents. Note the simple form of assembly and construction. Below, the spot welder is being used to attach the bottom to a wastebasket and, at right, a strip of metal is being shaped on the former.



PAINTING and decorating the finished article with the sprayer requires only a few minutes. Note the wide application of the outfit as shown by the articles in the border, all made with the aid of the metal-working equipment.

of bending, folding and making all types of seams. Attachments are supplied for rolling and beading flat sheets, crimping and flanging, punching and all other operations in forming. With the former, it is possible in a few simple operations to turn out sheet metal in any shape desired by running it through the machine.

To complete the equipment, he obtained a motor-driven paint-spray outfit for finishing the articles. The spray table is surrounded on three sides by a metal shield, and a revolving stand for the article makes application simple.

With these four pieces of equipment, working with sheet metal becomes simpler, easier and quicker than working with wood. Take the matter of making the wastebasket, for instance. The sheet metal is straight cut to size by running it through the jig shear. The edges are bent in the metal former and spot welded together to form the sides. The bottom is cut, folded on the shaper and put in in reverse to be welded. Wire is wound around a rod, pulled apart and spot-welded around the top. Lacquer spraying and deco- (Continued to page 130A)

Boat Resembling a Whale Attains High Speed



Latest High-Speed Craft Traveling at Fast Pace with Little of Its Bottom Touching the Water; Note Unusual Construction Enclosing the Entire Upper Section to Produce Resemblance to Whale

Having something of the appearance of a whale, the latest speed boat is streamlined, even to a hood over the driver's compartment. This hood conforms to the general lines of the craft. The boat, built of three-ply wood, measures sixteen feet in length, has a beam of six and one-half feet and a height of four and one-half feet. It is powered with a four-cylinder Ford engine operating through a V-drive. While the bottom is of new design, it embodies the conventional hydroplane step which enables it to skim over the surface at high speed with but little of the bottom submerged. The craft has been tested at high speeds.

"AIR-CONDITIONED" WASP ARMY WILL FIGHT COTTON PEST

Brought overseas in an air-conditioned transport, three squadrons of Egyptian wasps will wage war on the pink bollworm, most dreaded cotton pest in the world. Previous attempts to import the wasps, which have successfully protected Egyptian cotton fields, failed because they could not survive the long journey to the United States. Air-conditioned shipping solved the problem. Before being turned loose against the bollworm by the department of agriculture, the wasps will be given time to increase their army.

C. P. Clausen
 Dept. of Agriculture

ROAD OR RAIL TRUCK SPEEDS DELIVERY OF FREIGHT

For converting standard vehicles for service on highway or railroad, a simple unit is available. Its retractable pilot wheels can be installed on truck or bus, enabling the railroads to meet highway competition. The equipment permits store door pick-up and delivery without re-handling; reduces operating costs, since the vehicles have a smooth track instead of rough pavement on long hauls; develops new business through extension of service not reached by rail, but which can be reached on highways connecting with near-by railroads, and permits high speed, both on road or track, with safety.



Arrows Indicate the Small Pilot Wheels Which Guide Vehicle's Wheels on Rail

Auto Trailer
 Evans Products Co.
 Union Guardian Bldg. Detroit Mich

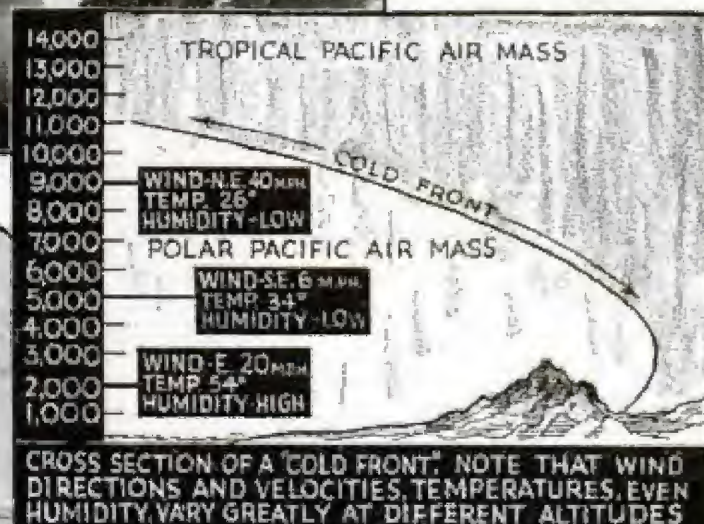
Scene 7/11/35

E 400 John A. Macey,
Box 292, Hollywood, Calif.

AIR MASSES Tell



Left, Transport Pilots Receive Weather Reports by Radio Every Fifteen Minutes; Below, Cross Section of "Cold Front" Moving in from North Pacific to Displace Warm-Air Mass from Tropics; Note How Warmer Air Rises above Sloping Front of Invading Polar Mass; in Circle, Dr. G. H. Taylor, Chief Meteorologist of General Air Lines, Broadcasting Weather Data to Pilots



knows already at what airport he must drop down to wait out a storm. As long as thirty-two hours before those two conflicting air masses meet and "make" weather, the air-line weather experts have calculated the effect and charted their predictions. This system of prophecy based on air-mass analysis is revolutionizing weather forecasts. So efficient is

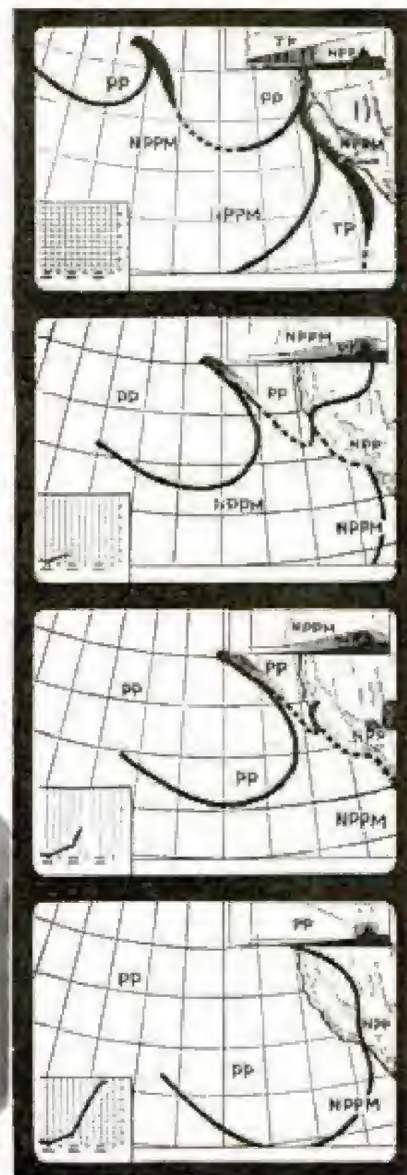
the method that the United States weather bureau is adopting its principles.

Air-mass analysis is based on the fact that the atmosphere is not a single body but many large bodies of air, each with distinct characteristics of temperature, humidity, velocity and density. They may be hundreds of miles in extent and several miles high, moving forty to fifty miles an

DOWN from the Arctic rolls a vast body of cold air, continent-wide, moving toward a head-on collision with a warm air mass out of the tropics. Squalls ahead!

At an air-line terminal a pilot climbs aboard a transport plane. He has his orders and his weather chart. He knows the flying conditions along his route, the most favorable altitude and winds, perhaps he

Future WEATHER



Left, Balloon Released at Weather Bureau and Man Noting Position at Thousand-Foot Levels to Check Wind Direction and Velocity; Right, Charts Show Tropical Pacific Air Being Supplanted by Modified Polar-Pacific Mass (NPPM) Bringing Rain to Los Angeles, Clearing as Polar-Pacific Air Approaches; Globe Shows Typical Air-Mass Situation

hour or perhaps stagnating at two or three miles an hour. Two or three such masses meeting and interacting precipitate unsettled weather. Polar masses are cold and dry. Masses originating in equatorial areas are warm and moist. These two types most commonly affect weather in the United

States. Unsettled weather usually occurs along the front of an air mass, because of interaction there between it and the mass it is displacing. In the path of a "cold front" advancing from the north will occur rapidly falling temperatures, squalls of rain or snow, and violent gusts of wind.



The warm front brings rising temperatures and sometimes rain out of the south. Since the front of an air mass is a sloping plane, regions of unsettled weather often cover areas hundreds of miles broad and long.

Picture a polar air mass that occupies a large part of the country. The weather is clear and cold. Up from the south blows a tropical mass. Meeting the polar air, it is forced to rise, for warm air is lighter. As it rises into the colder upper atmosphere its heavy freight of moisture precipitates as rain, hail, sleet or snow. The weather man can calculate how much precipitation there will be if he knows the relative humidity of the mass. To predict the type of precipitation he must know the temperature of the body of air through which it will fall. Snow is frozen while in vapor form, while sleet and hail are rain which freezes as it drops. Thus it is important not only to know the temperature, but the level at which that temperature occurs.

Every day government weather bureaus send airplanes three or four miles high with delicate instruments to record automatically temperatures, humidity, and density at various altitudes. These observations are made at a score of stations. At others, free balloons are released and

as they climb their courses are checked with "theodolites" to determine direction and speed of upper winds. The findings are collected by telegraph at a central forecasting station. With the data at hand, the meteorologist can calculate the width, length and height of air masses, for each mass will have identifying traits throughout. Long curved lines are plotted on blank maps to designate "fronts" of air masses. Within their boundaries are printed figures and symbols representing temperature, velocity, humidity. With the map

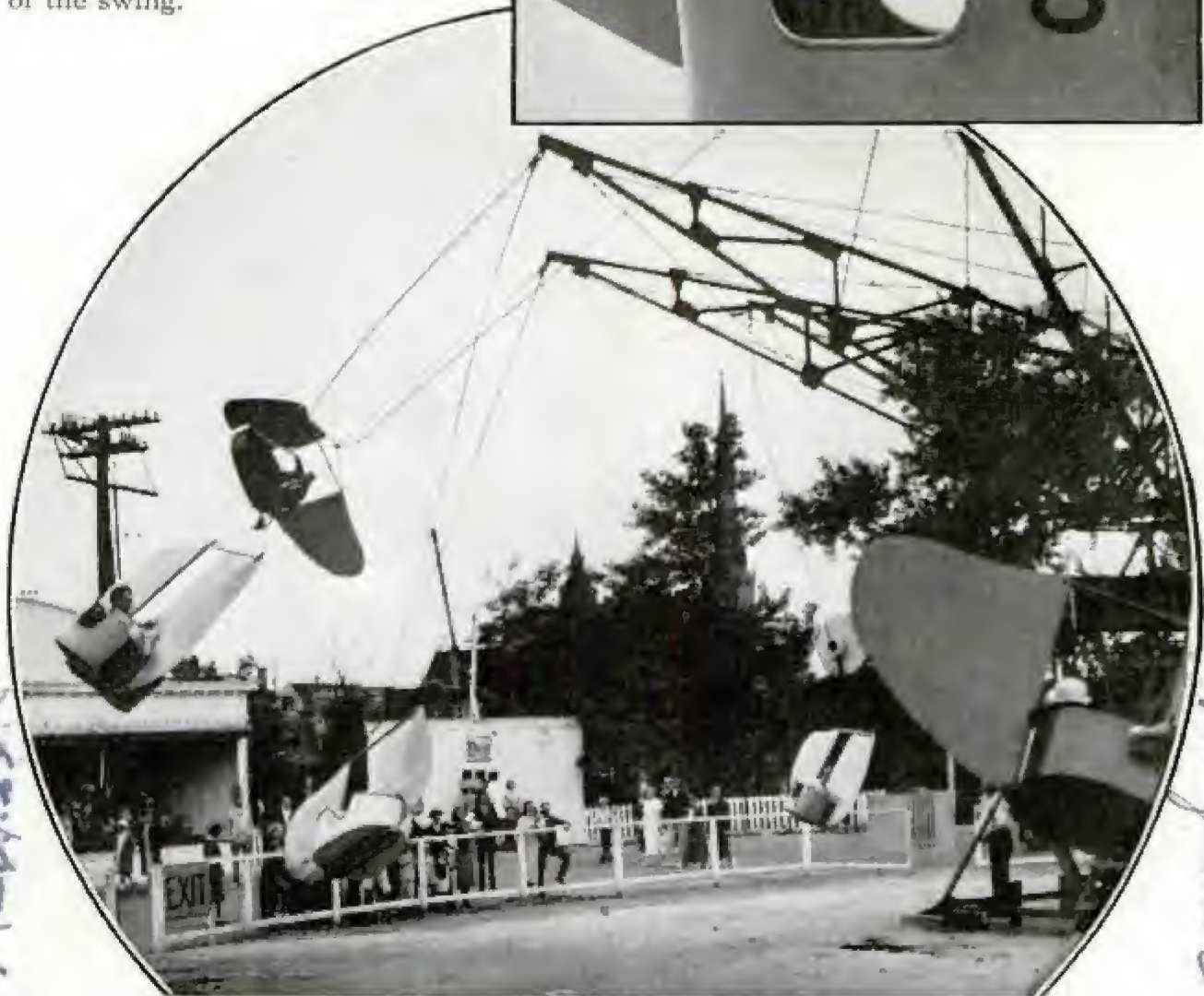
(Continued to page 128A)



Weather-Bureau Pilot, Top, Reports by Radio to Airport Officer, Below; Map Shows Teletype-Radio System for Distributing Weather Information

"Flying Scooter" Ride Has Motions of Plane

Giving the rider sensations of an airplane flight, a new amusement park device is the "flying scooter." Framework supports small cars suspended from steel "arms" by cables. As the framework is revolved by an engine, the cars swing outward. Vertical fins, attached to the car at front and rear, can be manipulated by the rider to change the direction of the swing.



Top, One of the Cars in Which Amusement Park Visitors Get a New Thrill; Bottom, the Device in Motion; Note Fins at Front and Rear That Permit Rider to Alter the Direction of Car's Swing

HIGHWAYS PAVED WITH SALT COST LITTLE TO MAINTAIN

Rock salt is proving an efficient and economical paving material on farm-to-market roads where traffic is light. An eighteen-foot salt highway can be built for about \$450 a mile. In road construction, rock salt can be mixed with clay or

other material and rolled to a firm surface, or it can be placed alternately in layers. The salt soon permeates the entire mass by capillary attraction. It compacts the clay into a concrete-like consistency and crystallizes the road surface, making it shed water during a rain, so that it does not become slippery or muddy. About twelve tons of salt are used to the mile.

Is permanent grade by Mr. Cloud

News Service 7/27/35

International Salt Co.
Granite, Pa.

'Auto' Driven by Pedals Has Room for Three



There's no gas or oil to buy when one Berlin family sets out for a spin. But it's a case of "no work, no ride," for their motorless car is operated by pedals and passengers and driver must do their share. The machine has places for three. The passengers sit on bicycle saddles, the two in the rear resting their hands on a bar as they pump the pedals. The pedals connect with gears transmitting the power to the wheels. The car has a regulation steering wheel. It is equipped with four wheels taken from bicycles. When all the passengers are working, it can go more than twenty miles an hour.

Passengers Operate Motorless Car by Pumping Pedals Which Transmit Power to Wheels

Exhaust Gas Peril Removed by Monoxide Eliminator

Carbon monoxide, the deadly gas from automobile exhausts, can be removed from the air by an eliminator developed by two Colorado inventors who sought a way of lessening the danger to mechanics working in gas-filled garages. Starting with a unit thirty inches high and fifteen inches in diameter, they plan to build a compact eliminator for permanent installation on moving vehicles, to help rid city streets of the fumes. A rubber tube connects exhaust gases to the eliminator, fresh air being added through small holes in the pipe just before it enters the unit. The hot exhaust fumes are exposed in the eliminator to hot, electrically energized, platinized wire coils which destroy carbon monoxide by replenishing the oxygen. Tested for months in a garage, the instrument kept the air constantly free from gases. It is expected to make possible the use of gasoline combustion engines in mines.



Photo and Diagram Show How Carbon-Monoxide Eliminator Unit Is Attached to Auto Exhaust

Denver Colo
E. J. J. J.
Robert J. Foregg
Ray J. Weaver

Wide World

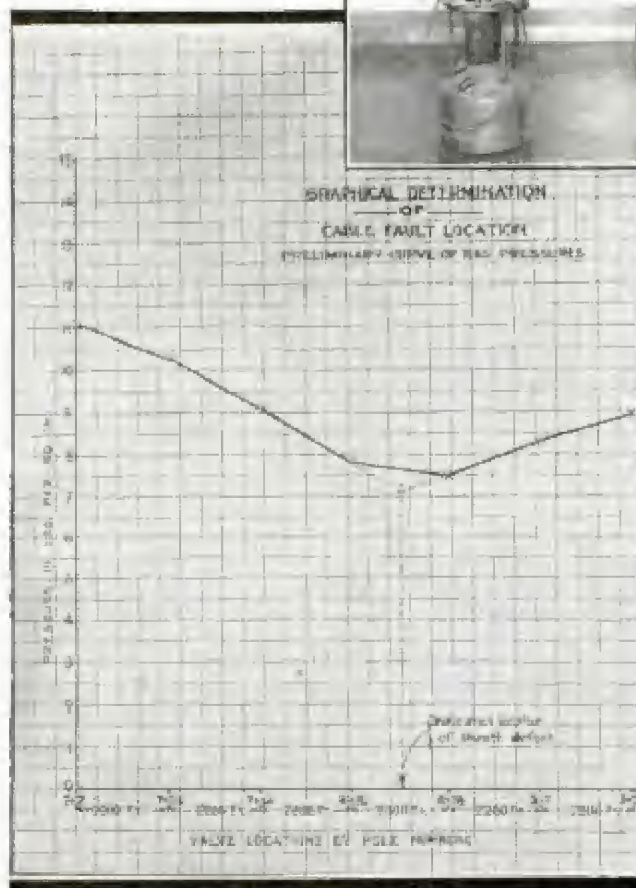
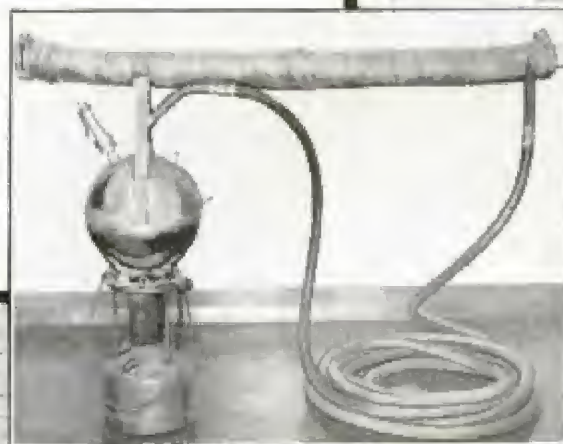
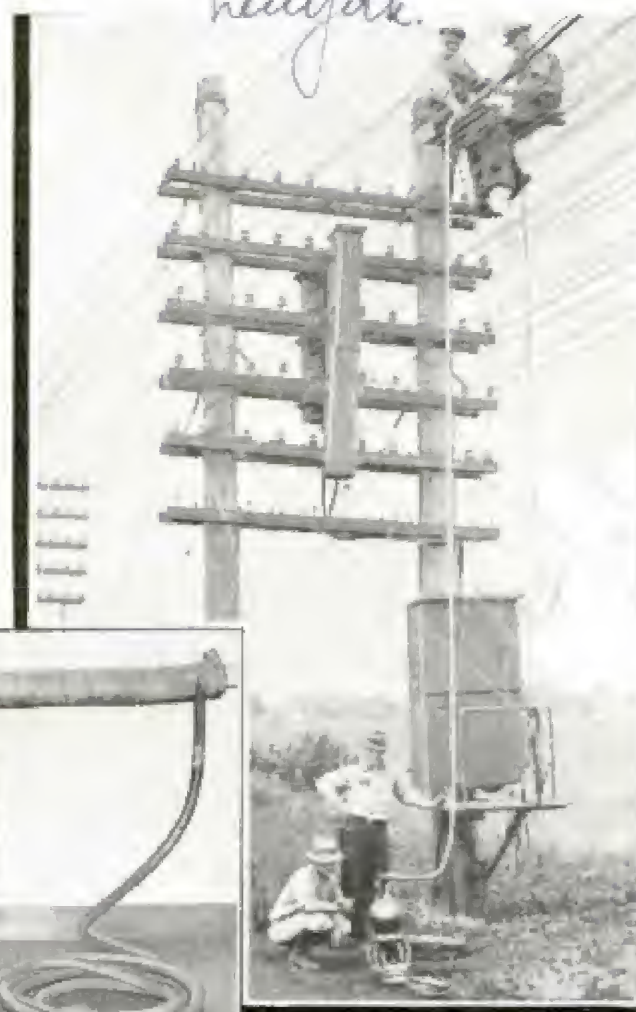
Ray J. Weaver
main push
monoxide

Monoxide Gas Is Consumed over Hot Electric Coils and Special Refractory Element

Telegraph Co. 60 Hudson St New York.

Soap Bubbles Find Leak in Telegraph Cable

By introducing nitrogen gas into lead-sheathed telegraph cables and then painting the outside with a soap solution, Western Union engineers are enabled to find leaks. Bubbles appear at any tiny crack or hole, indicating spots where moisture might enter and damage the paper insulation wrapped around each wire. If the insulation becomes wet, service will be interrupted. The soap-bubble process is applied at splices in the cable. Leaks between splices are located by measuring the gas pressure at several points and then plotting the gas-pressure readings with respect to the length of the cable. Low points in the curve so obtained indicate leaks. In making the gas-valve connections, the cable sheath is punctured with a tool that cuts a small disk out of the sheath without injuring the paper insulation. The valve stem is then



attached by mounting a small metal collar around the base of the stem and filling the collar with solder. Standard tire-valve insides are employed in the stems. To locate minute leaks, a differential pressure meter is used. Remarkably sensitive, this instrument is capable of indicating differences of pressure between two points in a cable as small as .00005 pound. The meter also shows the direction of gas flow within the cable, toward the leak, and by attaching it at several points in close proximity to the theoretical location of the leaks shown by plotting pressure curves, the exact span in which the leaks occur may be located. Tests on underground cable are made in the same way, except that readings are taken on sections within manholes.

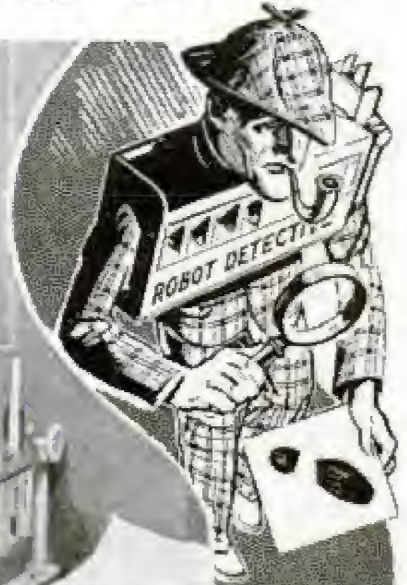
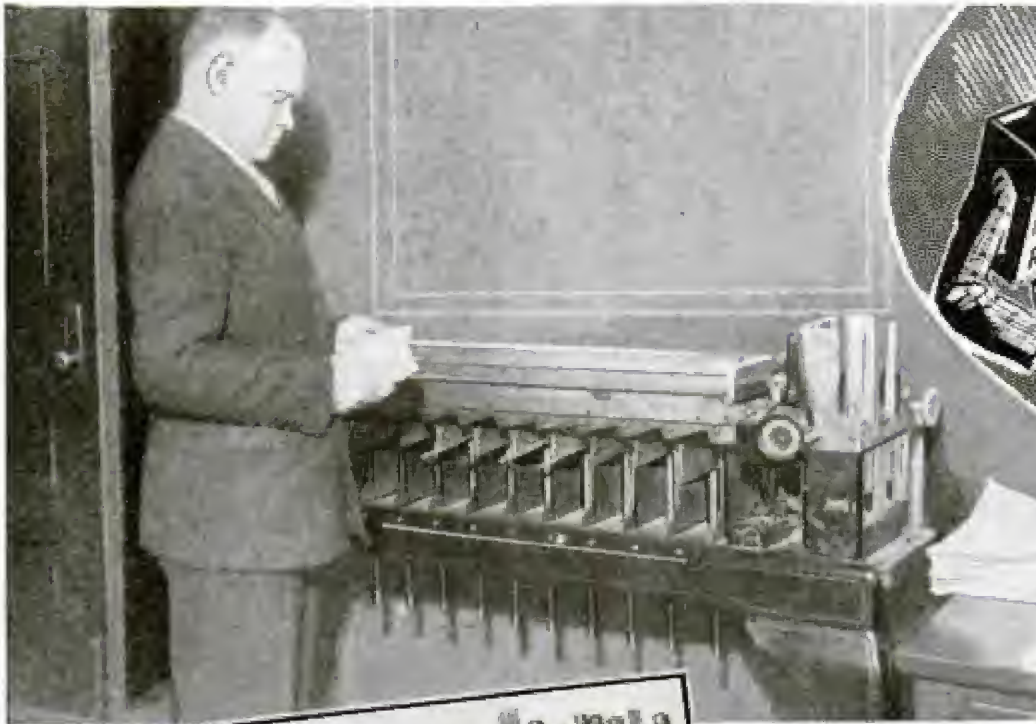
Top, Testing a Cable; Center, Equipment Attached to Cable; Bottom, Graph Showing Location of Defect in the Sheath

Our Bureau of Information will answer questions regarding articles in this magazine, if accompanied by return postage.

6732

Contr. Maxwell Field Leland
5412 Lelandale
Blod, Los Angeles, Cal.

Tattletale TRADE -



Top, Brains of the "M. O." System, the Sorting Machine Which Shuffles the Cards

SPOTTING crooks by their "trade-marks" is the latest police magic. Detectives call it analysis of the "M. O."—short for *modus operandi*, a crook's method of operation.

No one can escape his habits, and that fact leads even the shrewdest criminal to leave clues that become quite transparent to the M. O. expert. Sometimes it is a mere word, or a tattletale mannerism; other times, it is a pet instrument, or the way the criminal uses it, that betrays him.

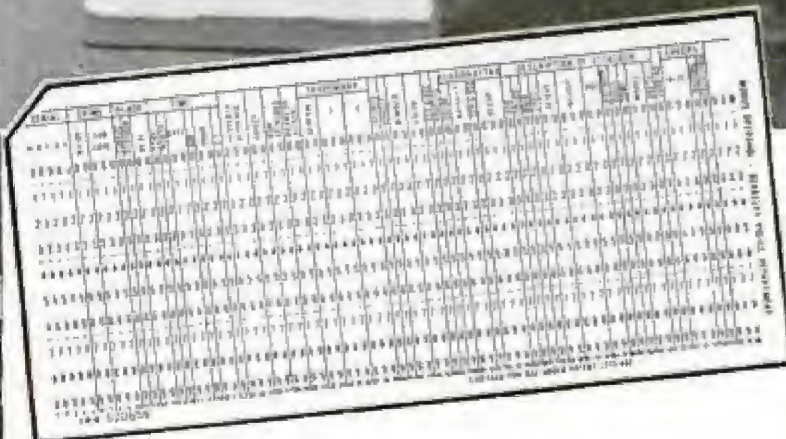
A cruising prowler car swung its spotlight upon a furtive figure slinking out of a dark



Kit of Burglar Tools Taken from Suspect, and Measuring the Jimmy Marks on a Garage Door

8932

Stillerith punch card system.
dis. cylindrical Puckner
New York



machines Carl 2 27 & Tabulating machines

Over the United States, similar machines are using their uncanny powers of deduction to "break" unsolved cases. Fingerprints play only a small part in linking criminals to their handiwork. The hotel burglar, the sneak thief, the footpad, the gunman—each of these has his characteristic traits and every individual has his own trade-mark.



Left, Selecting Cards from Police Files for Analysis by Robot Detective; Below, Typical Photos from Police Records Showing Burglars' Methods of Entering Buildings



"What's his M. O.?" a detective will ask. Given this information, he can use the sorting machine to run swiftly through thousands of separate cases cramming police files, marshaling crime after crime until common clues point to the guilty person.

Such a trail was left by a "barefoot burglar" at Berkeley, Calif. Night after night, three or four houses were entered and ransacked while the owner slept. The police learned to know the burglar by three trade-marks: First, he worked barefooted or in stocking feet. Second, he tied the window curtains back for a quick getaway. Third, he carried his loot from job to job,

often discarding less desirable articles in another house.

Finally, early one morning, an ex-football player victim brought him down in a flying tackle. The police did not need a confession to connect him with a long series of crimes—study of his M. O. already had done that.

Fast automobiles no longer can carry the crook away from his past record—it now travels ahead of him, thanks to a new code language spoken by eighty-two per cent of the police departments in the country. Years ago, the department of census found that mechanical sorters could be used for classifying huge masses of facts and figures, simply by translating each fact into a number code, then punching out that number in an index card. In secret police files, myriads of records are filed according to such a code, outlined by the department of justice. Long cards, each bearing as many as eighty vertical columns of figures, list necessary data. With a mechanical punch resembling an adding machine, an operator records information on these cards. One card thus may store up dozens of bits of information, and can be read instantly by one familiar with the

code. The brain of the whole system is a secret code-book in which every trade-mark has a number. If a bandit threatened to kill his victim, it might be indicated in the trade-mark column by the numerals "874"; while "891" might show that he asked the victim for a cigaret, and "142," that he used a toy gun. In the records of the Los Angeles sheriff's office, thousands of such trade-marks are listed. Run your eye down the list of key numbers and you find such telltale actions as the following:

Chewed tobacco; wore rubber-soled shoes; played the radio set; called on the telephone; wore a mask. One bandit had blindfolded the victim; another cut telephone wires or hid behind a tree or had a deformed hand or followed the victim home.

Once the information has been punched into the cards, the mechanical mind is ready to function. Another machine sorts them, 400 a minute, picking out those for which key buttons have been set. A detective can "ask" the machine for all crimes committed on the tenth of the month by a red-haired bandit wearing tennis shoes, and receive a neat pile of cards listing the ones in which those factors figured. Piecing together clues and descriptions by witnesses, detectives sometimes construct a "hypothetical criminal." Then, by setting the selector keys, they can pick out all cases where the criminal answered this description.

Not long ago, a burglar entered the home of a California minister. An officer analyzed the burglar's M. O. and sent a description to all police departments on the Pacific coast. The Spokane police responded by sending fingerprints, a photo, and a complete description of the man responsible. This burglar confined his attention entirely to ministers. Entering a strange town, he would watch the newspapers for church announcements, and would confine his operations to times when the minister would be away from home filling a speaking engagement.

M. O. analysis sometimes enables detec-

(Continued to page 114A)

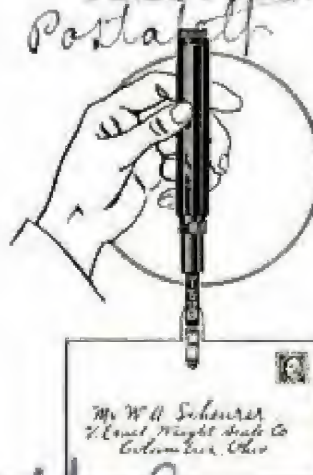


Wind Pressure and Suction on Airplane Wings Tested by Racing Auto Fitted with Wing and Delicate Recording Gauges

AUTO REPLACES WIND TUNNEL IN TESTING PLANE WINGS

Airplane wings are tested at one-fiftieth the cost of wind-tunnel experiments by a specially equipped automobile. A section of a wing is mounted vertically above the front seat. Tubes lead from the wing surfaces to a sensitized chart surrounded by fluid gauges. When the car is driven at racing speed the wind suction and pressures on the wing are recorded photographically on the chart.

PEN-SIZE SCALE FOR LETTERS FINDS POSTAGE REQUIRED



Resembling a fountain pen in shape and size, a pocket scale accurately weighs letters and other mail up to eight ounces. An accompanying circular indicates the amount of postage required according to the weight shown.

Columbus, Ohio

The Exact Weight

and Raymond S.
Quick Engineer
Inspector Bureau of
air Commerce, Washington, D.C.



Builder with His Odd-Looking Vehicle That Runs on One Wheel; Note Small Motor Used for Propulsion

ONE-WHEELED MOTORCYCLE RUNS ON LOW POWER

Driven by a one-cylinder engine, a one-wheeled motorcycle has been tested successfully in California. The vehicle is a wheel within a wheel, with the motor driving the giant outer wheel. A secret steering device allows the rider to sit upright while the wheel leans in turning.

PROPELLER BRAKE FOR PLANE MAKES LANDING EASIER

Airplane pilots can make smoother and easier landings by the use of a recently developed hydraulic propeller brake which eliminates "windmilling" when the throttle is closed, causing the flow of air over the wing adjacent to the propeller to be smooth instead of turbulent. This results in a higher lift for the wing and subse-

quent lower landing speed. Tests by engineers on the Sikorsky S-42 of Pan-American Airways showed that when an engine was stopped the brake made it possible to correct for loss of power by the use of the rudder alone, instead of by the usual method of rudder and ailerons. It was pointed out that in case engine failure was caused by a broken part, complete destruction of the engine and breakage of expensive parts could be prevented by the use of the propeller brake. The brake for four motors weighs only fifty-five pounds complete.

REED ORGAN GIVEN BIG VOLUME BY AMPLIFIER

Volume and tone of a large pipe organ are imparted to a small reed organ by an electric public-address system installed by Ralph Leister of Pennsylvania. Sounds

in the instrument are picked up by the microphone, amplified and sent out through five speakers. A switchboard controls the speakers. Colored lights back of the grill are operated from the console.



Reed Organ after Being Converted to Produce More Volume and Better Tone

Has as blueprint,
Plans nor Part.

Mr. Walter Nelson
Los Angeles Calif.
address

8861

Kittanning, Pa.

Kittanning, Pa.

Radio Car Tours City Giving Safety Lectures



Top, Right, Radio Car with Loudspeaker;
Left, Talking from Car; Right, Safety Lec-
ture Broadcast from Headquarters

If you cross a street against a traffic light in Jersey City, N. J., you may hear a loud voice warning you to wait. It is the "Voice of Safety," broadcasting on a two-way radio set in the police accident-prevention car. Touring the city and watching for traffic violations, the police broadcast from the loudspeaker on the car roof as they travel, telling a motorist if he makes an improper turn, warning a housewife at work that she is leaning too far out of the window, advising

children to keep off the street. An upright metal pole at the rear acts as antenna for the transmitter. With the two-way radio system the officers can broadcast through the portable microphone in the car or transmit lectures from police headquarters.

Dual-Operated Water Cycle Propelled by Hand or Foot

Built to accommodate several passengers with safety and comfort, the latest water craft is propelled either by hand or foot. The operators sit in the center, facing each other on seats resembling bicycle saddles. Pedals connected with a paddle wheel drive the cycle through the water. The operators can run it either standing or sitting down and any passengers can lend a hand at the same time. The cycle is shaped like a scow.



Operators Face Each Other on Dual-Operated Water Cycle Run
by Hand or Foot, Standing or Sitting Down

Originated by Sam Storie
1111 1/2 5th Ave. S.E. Seattle, Wash.

8792. Grant.

STEAM *Still*



Under Its Modern "Jacket" the "Hiawatha" Is a Standard Oil-Burning Steam Engine Stepped Up for Hundred-Mile-an-Hour Speeds

pull clear of the yards until you sight Milwaukee. I don't mean we never slow down. Sure, we've got to. Ninety is the limit on curves and eighty over railroad crossings. But there's no throttling down for that. Brakes do it. Keep her throttle open and hold her back with the automatic when you need to."

Over on the left seat of the cab is Fireman Ed Margolis. He's the reason why the engineer controls speed with brakes instead of throttle. Every touch of the engineer's throttle means an adjustment of the oil feed by the fireman. Speed her up five miles an hour, and Ed, observing every move of his engineer and every waver of the needle showing steam pressure in the boiler, must give his oil-burner a bit more fuel. Steam pressure in this modern grey-

FOUR hundred and ten miles in 390 minutes from Chicago to St. Paul!

Bill Dempsey pilots the Milwaukee road's speedline train with his eyes. The "Hiawatha" runs itself—almost. Bill Dempsey's hands are busy, but not with the throttle. They reach over to twirl a valve, or yank a lever that releases the blowout cock to clear the boiler. A hand grasps the automatic brake as a curve or railroad crossing rushes toward him. Mostly, Bill Dempsey's hands keep busy pulling the whistle rope. He leaves the throttle alone.

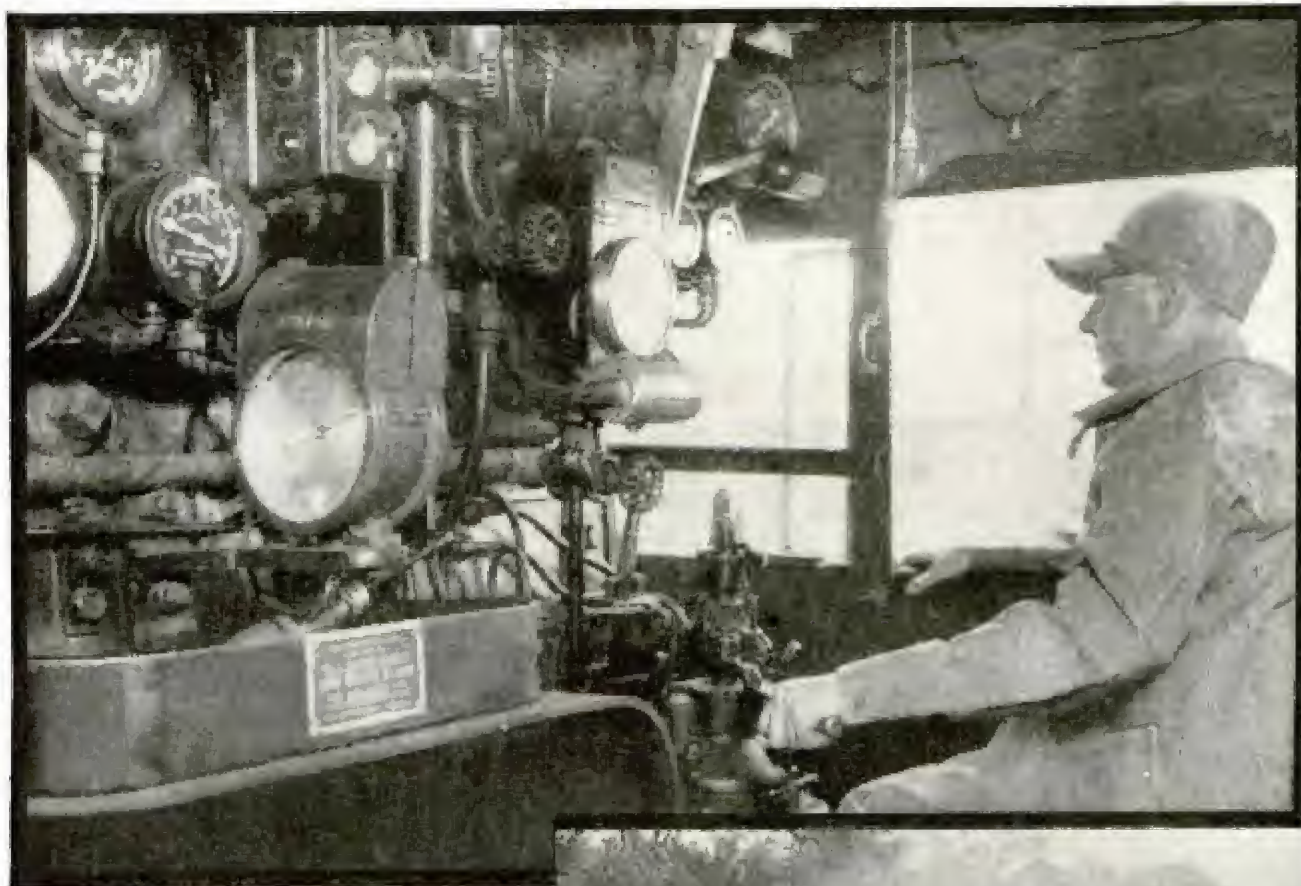
"Set her a bit over ninety and she'll take care of herself," he says. "Maybe we'll pick up to a hundred an hour. We may slack a bit on an upgrade. But you can take your hand off the throttle once you

hound of the rails is kept at 300 pounds, about fifty per cent higher than ordinary locomotives. If the engineer can keep his throttle steady, his fireman's job is that much simpler.

Fireman Ed works with his gloves off. He slips a fingernail into the "teeth" of his feed throttle and eases it over, a notch at a time, as the engine gathers speed. Engineer and fireman watch signals, each raising a hand as if in salute to tell his teammate "clear ahead!" Rocketing along at ninety and a hundred miles an hour there's no time for second guessing. Bill Dempsey knows the terrific momentum will carry him 6,600 feet—a mile and a quarter—even if he tries an emergency stop. He must allow 8,800 feet, nearly a mile and three-quarters, if he uses ordi-

8792

RULES *the* RAILS



nary braking power. Dempsey has been looking out of cab windows for forty years. Last year he piloted No. 6402 on a run from Chicago to Milwaukee that set international speed records, covering fifty-four of the eighty-five miles at ninety-two miles an hour. That engine, a powerful brute with six drive wheels, is a "stable-mate" of the "Hiawatha" at the Chicago roundhouse.

"We haven't tried to break that record with the 'Hiawatha,'" says Dempsey. "We could, easy enough. But engines have to be broken in easy, just like automobiles. The 'Hiawatha' has been let out to 115 miles an hour, and can do better. A hundred is the limit for ordinary runs. They check up on us, you know. See that meter? It tells me just how fast I'm going. Right now it's 104 miles an hour. Well, that's going down in writing on a tape inside that meter, and



Top, Engineer Bill Dempsey Keeps Hand on Brake, Eyes on Track; Bottom, "Hiawatha" Doing 104 Miles an Hour



Top, Coach and Beaver-Tailed Rear Parlor Car; Center, Engine No. 1; Notice Lack of Projecting Smokestack; Bottom, Left, Interior of Coach; Right, Windowless Cafe Room of Diner

when they open it up at the Minneapolis terminal the log will show the speed we hit all the way from Chicago to the roundhouse up north."

The "Hiawatha" has only four drive wheels instead of six. They're seven feet in diameter—none larger. This plant is built for speed. It hauls best a seven-car train, the cars one-third lighter than older types. It can pull ten, but is not meant to drag the heavy twenty-car trains the "6400" type can haul.

With speed, there must be more braking power. Older locomotives have brake shoes only on one side of the drive wheels. The "Hiawatha" brakes squeeze in on both sides of the drive wheels, the four "pony truck" wheels in front and the two "engine truck" wheels beneath the cab.

Nothing is left to chance. Braking power is doubled. There is the automatic train brake and the separate engine brake. Train crew can signal the engineer with a

whistle cord. Engineer can fling a warning ahead with an air-driven bell, a musical horn or a regular steam whistle. There is a marker jutting out from the rear car to show the engineer he hasn't dropped part of his train along the line. Halfway to Milwaukee, Bill Dempsey tests the water glass to be sure it's gauging correctly the level in the boiler. About the same time, Ed Margolis lifts four big scoops of sand to the six-inch vent in the firebox and lets the draft suck it in. Black smoke belches momentarily as the oil soot is swept from the tubes and smokestack.

Bill Dempsey and Ed Margolis climb down from the cab in Milwaukee at the end of the seventy-five minute run. A new crew checks her over, water is taken on, and in less than five minutes the Milwaukee trainshed is slipping away. At Portage, Wis., the train-control wayside signal begins flashing in the cab. From Portage to Minneapolis, block signals turn on a

white, green or red light in front of the engineer. If the light is red, a shrill whistle inside the cab gives added warning until the engineer sets his brakes. The Milwaukee road has not had a passenger fatality in seventeen years and this is part of its safety system.

Two-minute stops at Portage and New Lisbon, five minutes for water and another change of crew at La Crosse, then across the Mississippi river and on to Winona, Red Wing, St. Paul, Minneapolis and the roundhouse. Two hours before the race started from Chicago, Dempsey and Margolis were at the "stables" to look over their iron horse. The roundhouse crew has given the engine a thorough "rub-down," running repairs; buttoned the stream-styled "jacket," tightened nuts and examined journals and lubricating system.

"The old picture of a grimy engineer standing by with three-foot oilcan at every stop doesn't go any more," says lanky Walter Bates, assistant master mechanic of the line. "There's automatic lubrication on this locomotive, and it needs nothing but a drink of water from Chicago to the Twin Cities. The engineer can leave his oilcan at home with his lawn mower."

Ed Margolis, before the start, climbs aboard the tender to satisfy himself oil and water tanks are full. Trim and clean as a painted toy, the tender carries 13,000 gallons of water and 4,000 gallons of oil. Water must be taken at Milwaukee and La Crosse, but there's enough oil stowed away for a round trip to Minneapolis, although it is refueled at each terminal.

"That's how we make time," says Ed. "No stopping at every coaling station for five or ten minutes."

(Continued to page 136A)



Top, Sprinkler Fed by Telescopic Pipe Sprays Wide Area as It Rolls across Field; Bottom, Pump Delivers Water from Creek to Irrigator

FARM SPRINKLER ON WHEELS IRRIGATES WIDE AREA

Rain-making for farm crops has been made easy with a sprinkler eighty-two and one-half feet wide that rides the length of a field on two-wheeled dollies drawn by a hand winch and sprays the land with water pumped from a near-by creek or ditch. Two men can operate the irrigator on any level or hilly plot handy to water supply. Water is sprayed from the moving pipe or boom, fed by a telescopic pipe connected at right angles to the center of the boom. At the end of the field this telescopic "main" is coupled to an ordinary pipe tapping the stream. A high-powered centrifugal pump with four-inch intake and outlet delivers up to 600 gallons a minute at ten to thirty pounds pressure, according to distance it must be forced.

*Champion Corp
Hastings, Neb*

8542.

Mr. Thomas G. Blumson, Jr.
10555 Holman,
Los Angeles, Calif.

NIGHT OWLS of the



Top, Pilot Receiving Clearance Papers Before Take-Off, Night Transport Ready to Leave and Ground Operator Bringing in Fog-Bound Plane by Listening to Motors and Talking with Pilot by Radiophone; Below, Co-Pilot Using Plane's Radio

AT 3:40 each morning a radio operator in Tucson snaps a switch, lifts a hand microphone and says: "Tucson to Waco 151, go ahead."

Above the squalling of short-wave notes and the crackle of static a metallic voice answers him from the loudspeaker.

"Waco 151 to Tucson, fifteen, S ten, at seventy-five hundred C A V U sixty-five."

A 180-mile an hour sleeper plane of American Airlines, roaring through the night with twelve passengers, is reporting its position and weather. Translated into everyday terms, the

8542



Dispatcher Marking Up Latest Report from Plane, Radio Operator Phoning Weather Reports to Approaching Ship and Sleeper Night Plane Which Is Guided by Radio

pilot's jargon means that westbound plane No. 151 is in Block 510, flying ten miles south of the true course at a 7,500-foot altitude, that the ceiling and visibility are unlimited, and the temperature is sixty-five degrees. Before signing off, the ground operator gives the pilot the weather to the west from reports collected five minutes before.

All through the night, unseen watchers on the ground keep contact with the plane with their radio eyes. Operators at government stations watch over the automatic keys that trip out the dots and

dashes of the radio beams. At company stations, other operators collect weather reports, file messages for relaying, and talk to the planes. At department of commerce stations along the airways men keep their ears tuned for the radio-beacon signals to make sure they never falter, while other operators listening to airplane radio traffic stand by for emergency messages.

At the Los Angeles terminal of the airway, Bart Cox, flight superintendent, studies the radiograms showing the plane's progress, and glances at the weather map. Even if the weather is doubtful he may

American Airlines 515
Island Central Terminal
Islandale, Calif.



Unloading Mail, Typical Message from Pilot and Chart Showing Path of Pilot Flying by Instruments in Locating Himself on Beam and Approaching Field after Having Been Lost



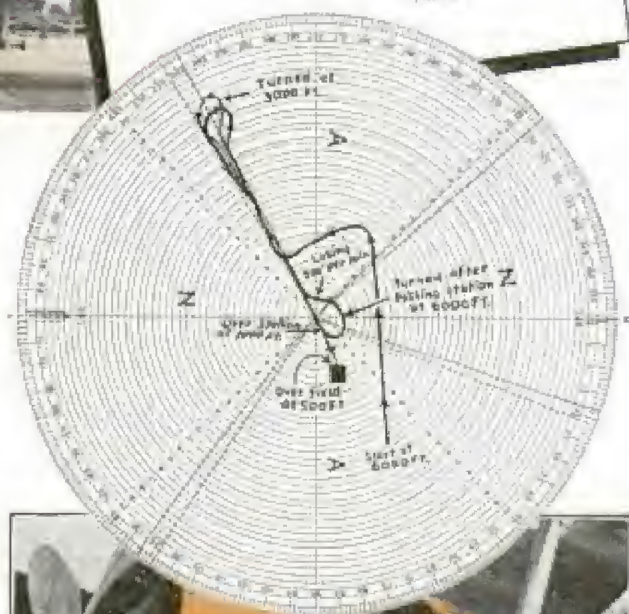
see signs of improvement and issue a clearance to the pilot that will bring the ship in on time. If the weather is unsettled along one stretch, Cox diverts the plane to an alternate route. If the terminal field is hemmed in by fog he instructs the pilot to land at a better field. Even if the pilot has been flying above the clouds at night for hours, he knows his position to the last mile and hits the airport "on the nose."

If you should walk up to the pilot's cockpit you would find the first pilot sitting behind drawn curtains, guiding the plane by radio and instruments while the co-pilot checks the course by glances through the window. With no necessity for flying blind, the pilots build up hours of experience against the times when they will be forced to fly through fog or above the clouds.

"A pilot keeps track of his progress by listening for the 'cones of silence' as he passes over the radio-beam stations and for the 'squawker' radio beacons along the airway," Cox says. "The airway is blocked off into numbered ten-mile squares and a pilot gives his location by the block he is in. Every minute a plane is in the air I can tell its exact position by checking its last radio report against the block map. Before the block system, the pilots flew by landmarks.

"Five minutes before landing, a pilot

(Continued to page 118A)



Inspecting Engine of Overnight Sleeper Plane during One of Its Stops for Refueling

Smoke Tests Boat Sails to Find Wind's Effect

For determining the effect of the wind on sails, C. Townsend Ludington has devised a novel smoke test in experiments with streamline boats. A specially constructed pipe directs the smoke to a point in front of the sail, from whence the wind causes it to flow against and around the canvas. A movie camera records the flow so that the experimenter may study it later. The boat on which the tests have been made is a curry boat imported from Germany. It has a gaff-rig type of mainsail with overlapping jib. The spinnaker also is employed when sailing down wind. The hull, twenty-seven feet long with a five-foot beam, resembles a whale about to submerge. Mr. Ludington is con-



White Smoke Curts against the Sails, the Cameraman (Right) Gets Movie Shots of Wind's Effect on the Boat's Canvas

ducting his experiments in an effort to make boats faster by changing sail design.

Indoor Poultry Farm Operates Like a Modern Factory



Latest Type of Poultry-Raising "Factory"; Note That Each Bird Is in Separate Pen

Between 10,000 and 12,000 birds of all ages are being raised on an indoor poultry farm in New Jersey. Each hen is kept in an individual cage, resulting in positive control over egg production. As the egg is laid on the wire floor, it rolls out and can be gathered conveniently. A record is kept on a small card attached to the cage. Thus, non-layers can be replaced by new pullets to keep the plant at maximum production. The indoor farm occupies one-half acre of land. Since the buildings are heated in winter, the birds experience no off season and continue laying at a good rate throughout the year. Feed and water are supplied to the chickens automatically for twelve hours each day. Complete ventilation and sanitation systems keep the birds in good health. So efficient is this method of egg production that it resembles the modern factory, turning the raw material, which is the feed, into eggs and thence into cash, without the usual waste experienced on the outdoor poultry farm.

M. H. C. and his family

C. Townsend Ludington, Philadelphia and Walnut Philadelphia, Pa.

Oil Spray Makes London Fog for Movie Sets



In filming San Francisco waterfront scenes for a United Artists' production, a stage 172,000 square feet in area was shrouded in realistic fog produced by atomizing ordinary mineral oil and forcing it into the air under high pressure. Air lines connected a series of atomizers and were controlled by a battery of valves. By regulating pressure on the atomizing nozzles the mist makers can create London fogs and various atmospheric effects at sea. For low fogs, cakes of ice are heaped around the jets to keep the temperature down; for high fogs the temperature is raised. For interiors, when the script specifies fog entering a window, Chinese incense is used, since the oil would mar the finish of furniture.

Vaporized Mineral Oil Sprayed by Nozzles under High Pressure Creates Realistic London Fog and Sea Atmosphere Effects for the Movies; Formerly Smoke and Combinations of Ammonia Gas Were Used, but Because of Their Irritating Effect They Were Abandoned



RULES FOR INDIANAPOLIS RACE ARE AIMED AT SAFETY

Regulations intended to safeguard drivers have been adopted for the 1936 race at the Indianapolis motor speedway. Drivers unfamiliar with the track will be required to make apprentice runs of 125 miles, ten laps at eighty miles per hour, ten at ninety, ten at 100, ten at 105 and the last ten at 110. No new driver will be qualified, nor will any new car be entered for the

race until the measure has been met. In addition, the speedway management will set up a laboratory equipped with an X-ray to examine all steering knuckles and other car parts subject to strain. Cars found defective will not be allowed on the track, even for practice runs. Fuel allowance for the 500-mile race will be thirty-seven and one-half gallons, five less than in 1935. Superchargers will be permitted in 1936, attracting foreign drivers, most of whom use superchargers.

Capt. E. V. Dickentracker, Chairman Control Board, in charge of

Cmd. Thomas E. Sumner Jr. Los Angeles Calif
10555 Holman Ave

Cmd. Joe Capko
c/o Speedway

8838

Capt. E. V. Dickentracker

Giant Bomber Flies Four Miles per Minute



International
Huge Four-Motored Bomber Designed for Army Is Too Large for Hangar at Home Port; Observe Glass Nose; Ship Has Five Machine-Gun Turrets Protected by New Type Unbreakable Glass

Capable of flying four miles a minute or better, a giant four-engined ship undergoing tests for the United States army air corps is expected to prove the fastest and longest range bombing plane ever built. On its first test flight the quartet of 700-horsepower motors lifted the fifteen-ton air dreadnaught off the field in ten seconds. Its designers, the Boeing Aircraft company, say it will do better than the 200 to 250 miles an hour top speed required by army specifications at a 10,000-foot altitude, and would exceed the required cruising speed of 170 to 220 miles an hour. It is capable of flying six to ten hours at ordinary cruising speed and operates at a 20,000 to 25,000 foot ceiling. Largest land plane in America, the bomber is of the all-metal midwing type, smoothly streamlined with landing gear and tail wheel retractable entirely out of the air stream. The wing span is 100 feet, and the ship is seventy feet long and fifteen feet high. The four Hornet engines drive three-bladed constant-speed propellers. Details of the design and equipment are shrouded in military secrecy, but it is known there are five machine-gun turrets jutting out from the aluminum body, each protected by unbreakable glass of a new formula. Boeing officials say it is the first fighting plane able to complete its military mission in the event one engine ceases to function. The plane has an automatic pilot to aid the crew, two-way radio telephone and a radio "homing" device.

COIN-IN-SLOT PARKING METER BRINGS REVENUE TO CITY

"Pay as you Park" is the rule on the downtown streets of Oklahoma City. The city has installed meters along the curb and as the motorist leaves his car, he drops a nickel in the slot. A clock-like contrivance raises a red indicator that stays in position for the allotted time. Policemen issue summonses to car owners parked with no indicator showing.



Home
Curb Space Pays as Meter Takes Nickel from Motorist for Downtown Parking

Dual Parking
City. Okla.

6462

James Mc Gueeny
2222 Sherman Ave
Evanston Ill.

Machine-Made HEROES



Top, Charging Padded Dummies Shaped Like Players in Defensive Positions; Below, Forward Passers Using Old Tires as Targets

BUILDING a football team today is a scientific process and mechanical aids are becoming most important in the development of gridiron heroes.

Unlike baseball, which presupposes natural ability, football is a game that can be taught. With the necessary physical and mental equipment, many men who never stepped foot on a field before entering college have developed into great stars un-

der the guidance of leading coaches.

A coach's football system, fundamentally, is very simple. Herbert O. Crisler of Princeton University summed it up when he said: "I try my best to teach my players to block well and to tackle well. If they learn to block and tackle better than their opponents, they nearly always win. If they don't, they nearly always lose."

Football is a complex game but blocking and tackling are its two most important fundamentals. Blocking is the basis

of the GRIDIRON

Charging a Rocking Dummy, and Sighting Device Which Aids Head Linesman; Below, Charging Traveling Dummy Which Imitates Human Player



Top Photo © Arthur Dalley

of a team's offensive play and charging and tackling its defense. The technique of good blocking, needed in the execution of a kick, a pass, a line smash or a flank play, is taught today with the help of mechanical aids. Likewise, the muscular coordination, proper timing and correct judgment of distance necessary for the execution of a good tackle can be illustrated more satisfactorily with a tackling dummy than on a live player.

Guards, tackles, centers and ends are taught the principles of the running side-body block and the open-field block on standing dummies, made of army duck with leather bases and filled with sawdust. These are used in a series and arranged

so that they swing on a trolley. The rebound in these dummies, thirteen inches in diameter and four feet tall, is provided by a greased coiled spring or heavy elastic cable in the lower center, and a heavy web couples the end of the elastic cable to an



Top, Football Training Machine Which Combines Several Units; Center, Machines Helped Train These Players; Below, Going through Scrimmage with Aid of Self-Erecting Dummies

anchor imbedded in concrete beneath the ground level. Direct strain on the dummy or straps is precluded by a heavy adjustable strap, the lower end of which is looped through the top of the elastic cable and the upper end fastened to a hook connected to a ring on the cable.

Tackling dummies, which range from mere bags of sand suspended from wooden framework to complex mechanisms that duplicate human movements, engender confidence in the player and teach him the

proper way of downing a ball carrier. A dummy swinging from a crossbar that does not fall with the tackle is first used to teach the novice to squeeze hard with his arms and hold on when making the tackle. Most coaches line the players up in front of the dummy in a defensive position. The player, after hitting an imaginary opponent with his hands, charges forward at the dummy, going through the actual motions he might use in a game.

Flying tackles are taught by putting an obstruction in the path of the tackler. He leaves his feet at this point, usually five or six feet from the dummy, and throws himself at the dangling figure. Players, too, sometimes block the path to

the dummy so tacklers learn to dodge and use their hands on players running interference for the back carrying the ball.

An automatic tackling dummy that forces a player to exercise leg drive and the correct form in tackling is now being used. The farther it is carried out by the tackler the more resistance it offers. An adjustable spring makes it possible to offer whatever opposition the coach desires. Some tackling dummies are hinged at the

(Continued to page 116A)

Welding Rails Together Takes Out "Clicks"



Above, Molten Steel Pouring from Crucible into Mold around End of Rails, Thermit-Welding Them into Solid Ribbon of Steel; Left, Thermit Weld Was Used to Repair Breaks in This Huge Casting, Twenty-Two Feet High and Fifteen Feet Wide

Each click of the car wheel as a railroad train thunders along the track is really a battering blow that slowly but surely breaks down the rail ends. By converting miles of standard thirty-nine foot rails into unbroken rails, welded at every joint, railway engineers believe they can cut millions of dollars from the cost of maintaining the track and replacing worn rails. The Delaware and Hudson has already installed several stretches of welded track more than a half mile long. Thermit welding is the process used. Over the rail joint is placed a crucible containing two metals which, when ignited, react violently for about thirty seconds at a temperature around 5,000 degrees Fahrenheit. Then the crucible is tapped and white-hot fused steel flows into a mold box around the rail ends, which are forced together by clamps under enormous pressure. The resulting pressure butt weld is stronger than the rail itself. When cool, the joint is ground smooth. None of the welded rails have caused any trouble by expanding or contracting with temperature changes.

TIRES ARE VULCANIZED QUICKLY WITH UNIT FOR SMALL SHOP

Repairing breaks in auto tire casings is a quick and easy job with a handy vulcanizing outfit now being manufactured. Equipped with it, small shops and garages can do their own casing repairs. Mounted conveniently on a pedestal, the vulcanizer is raised or lowered on a C clamp by means of a handle turning a screw. The tire is placed on the lower, stationary part with a sandbag under the spot to be mended. The vulcanizer is lowered and clamped over the patch with pressure, then heat is applied electrically and in a short time the job is done. Deep bruises and cuts clear through the casing can be repaired in this way.

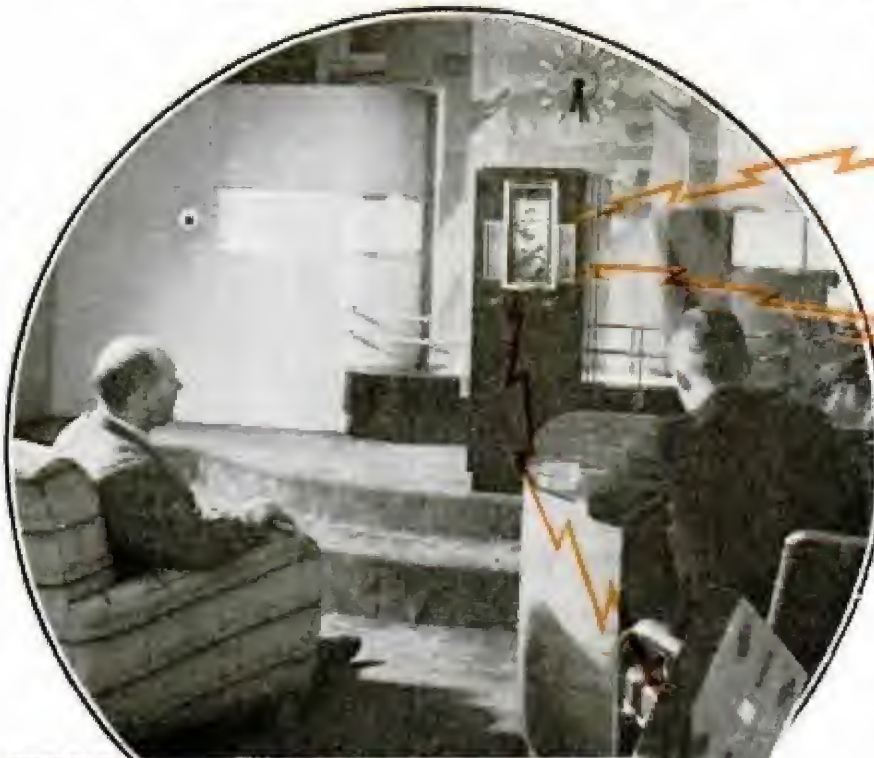


James C. Heintz Co.
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TELEVISION on



that the desire for home receivers is increasing daily. Factories are now turning out television receivers which answer all the specifications laid down by the British general post office. When the production machinery is running smoothly, a home television receiver of high definition will cost no more than \$100, it is expected.

The British Broadcasting corporation has admitted two companies in the field, both linked to American television interests. The Baird Television company uses the electron camera patented by the Farnsworth Television company of the United States; while the



TELEVISION has gone on trial in England. Such entertainment already is a commonplace for thousands of radio fans living within the limits of greater London.

After accumulating several years of experience in building and transmitting thirty-line television programs, the British Broadcasting corporation has launched its program of expansion, which brings into prominence the foremost radio interests in Europe and America.

The variety of entertainment and spot newscasts is of such great public interest

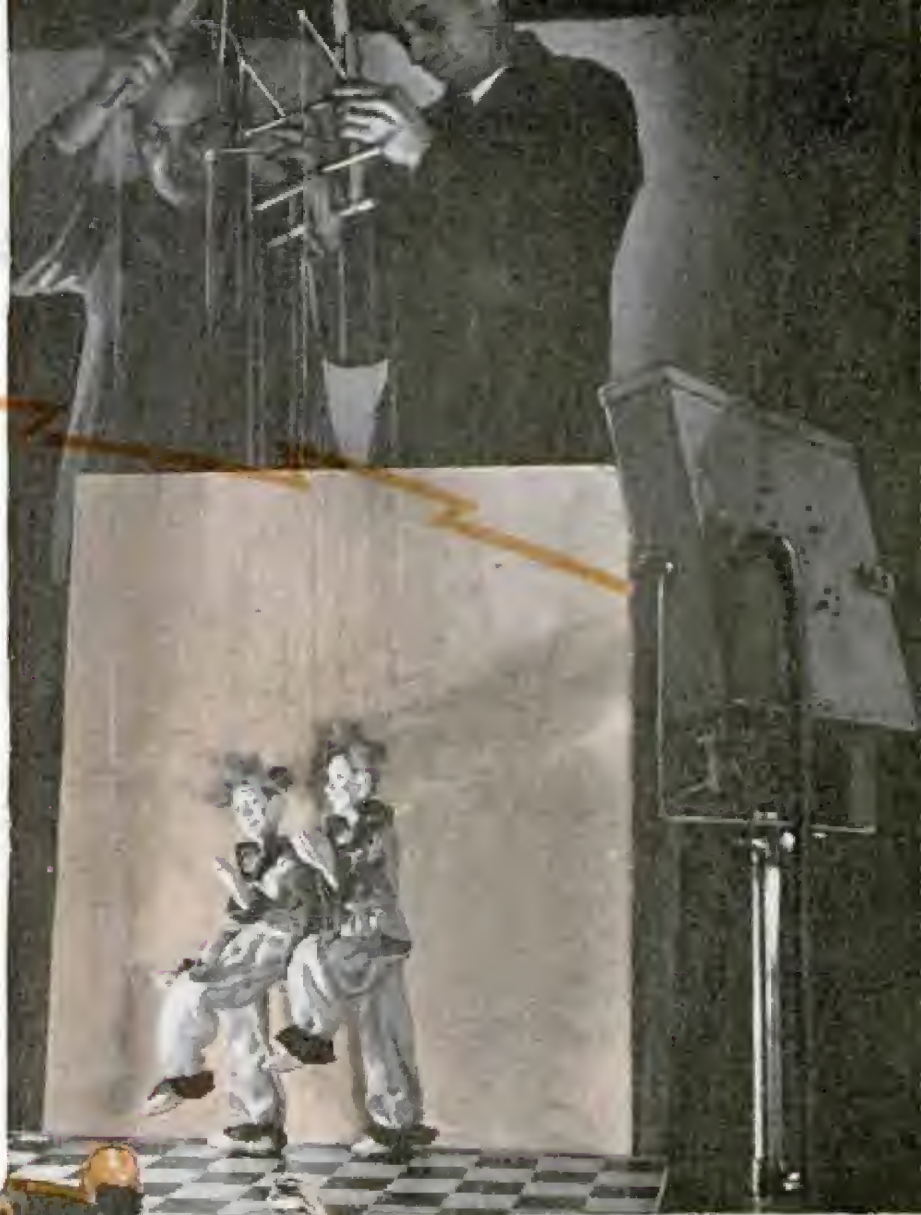


All Photos © British Broadcasting Corp.
Watching British Television Program, and Performers as They Appear in Broadcasting Studios

TRIAL

Marconi Television company is closely linked with the Radio Corporation of America and plans to use the "iconoscope," or electrical scanner, produced by Dr. Zworykin. The scope of Britain's television service will soon expand to take in movies as well as home entertainment. For the last six months Baird engineers have been working on a system for reproducing television images on full-size moving-picture house screens.

This movie service is made possible by a method which allows the moving-picture projection room to receive television images direct from some outside source. These images are immediately impressed or developed



on film which runs through the regulation projector. Trials have already been conducted between Crystal Palace and a London moving-picture house. This movie service will be entirely different from that which is broadcast to the homes. It will place pictures of high definition before movie audiences, and it is expected, thereby, greatly to increase the revenue of moving-picture exhibitors.

"This new development," said Captain A. G. D. West, technical director of the Baird company, "will bring television of news events to all the cinemas, and will result

Televising a Full-Dress Ballet and, Above, a Marionette Show, Thus Demonstrating the Versatility of the Equipment Employed



in enormously increased revenue for them. It may, in fact, revolutionize movie entertainment. Only a few years ago the movies were revolutionized by the advent of talking pictures. Within the next twelve months, we shall see a further revolution in the advent of television to the cinema.

"Instead of crowding around a loudspeaker to hear the result of the derby, as has been done in the past, people will be able to go to their local theater and see the event as it happens. Not only will day events be dealt with in this manner, but any night event will be screened exactly in the same fashion.

"Furthermore, a new cable development makes possible a thing which has hitherto been regarded as impossible—the transmission of what may be called distant events. These new cables will carry television signals without any loss in quality, and they make it possible to transmit news pictures for at least 700 miles."

As Captain West sees it, transmission on a 240-line definition is the best that has

been developed so far. As engineers of the Marconi company see it, the best transmission is with a 405-line definition.

"With our system of interlaced scanning," said an official of the Marconi company, "we make not only a picture of much higher definition, but one which is entirely free from flicker; the number of pictures is equivalent to fifty per second. The electric television scanner has all-round applications for studio, film and outdoor work. We have secured perfect television pictures in driv-



Sea Lion Playing a Saxophone during British Television Program, and a View of the Television Control Room

ing rain and dull weather. Several 'electric eyes' can be used on the same movie set, so that we can play tricks that are probably beyond the scope of the ordinary cinematograph camera."

As the supreme authority for British broadcasting, the British general post office has set up a supervising television committee. On the advice of the committee, the new television service is intended to be a free proving ground for any inventor who has a worth-while device to try out. All television receivers manufactured for Great Britain have the capacity

(Continued to page 135A)

Homemade Dolls Earn Money as Art Models



Homemade Fairies and Elves Seem More Real When Photographed in Outdoor Setting



Above, at Work in Home Studio Surrounded by Tiny Life-Like Figures; Left, Dolls Posed for Camera Study to Be Used as Illustration



Below, Cleverly Designed House Fly and Paper Figure Posed Dramatically to Advertise Brand of Fly Spray



Fashioning Dolls of Paper and Cotton as Models for Cartoons, Camera Studies and Advertising Is Profitable Home Industry and Pastime; Two Denver Artists Have Created Scores of Dolls to Illustrate Books and Dramatize Products in Advertising; Some of Them Are Shown Above; in Circle, Toy Angel on Cotton Cloud Signals Stratosphere Balloonist for Ride; at Right, Paper Cinderella Whispers "Sh-h-h!" to Miniature Grandfather Clock

Conk Frank Conley 986 S Pennsylvania St Denver, Colo

See Sept. 1933 326

Drive-In Theater Has Speaker for Each Car



Top, Screen 2,000 Square Feet in Area at Drive-In Theater; Below, Bucket-Shaped Individual Speakers Attached to Railings in Front of Parking Rows Bring Sound to Each Car

Solving the problem of sound control, the proprietor of a drive-in movie theater has installed individual loudspeakers for every car that parks for the show. The low-volume, bucket-shaped magnetic speakers, numbering 460, are attached to railings directly in front of the parking rows. They aim the sound at the spectators through the radiators of the cars and can be turned off in any unoccupied sections of the ten-acre enclosure. Formerly three huge dynamic speakers, twenty-two feet long and seven feet across the opening were used, but their sound production could not be controlled and they were sometimes heard blocks away. At capacity more than 2,000 motorists can enjoy the movies at this theater. The spectators' cars are placed on a slight incline, so that the back-seat patrons may view

the picture with ease. The screen is forty feet by fifty feet, set in a structure seventy-two feet high and 132 feet wide.

Sound Speeds Up Potato

POTATOES have been stimulated into earlier sprouting and blossoming and larger tuber yield at maturity by subjecting the seed pieces to sound waves far beyond the range of audibility. Experiments at the Soviet state X-ray institute resulted in increasing the yield by from sixty-four to sixty-nine per cent. The sound waves were produced by an electrically excited quartz crystal operating in an oil bath at a frequency of about 400 million cycles per second. The uppermost limit of audible sound waves is only about 20,000 cycles.

FISH ARE LURED BY FLASHLIGHT IN PLUG FOR NIGHT TROLLING

When other baits fail, the glow of a tiny flashlight encased in a fishing "plug" is a reliable lure, especially for trolling at night. A bass fishing "plug" now on the market contains a miniature battery and bulb, held by a clip and easily replaceable.



Science Service
7/2/35

Research and
Model a East Hartford

Sound experiments in U.S.
Prof. R. W. Wood of
Columbia University

Drive-In Theater
Pico Drive Westwood Blvd
Los Angeles
Calif

878 A Unit, Baltimore, Md
878-4
FISH ARE LURED BY FLASHLIGHT
IN PLUG FOR NIGHT TROLLING
When other baits fail, the glow of a tiny
flashlight encased in a fishing "plug"
is a reliable lure, especially for
trolling at night. A bass fishing
"plug" now on the market contains a
miniature battery and bulb, held by a
clip and easily replaceable.

new model
will. O. W. Welp
1497

BILLIARD TABLE TOP FOLDS FOR GAME OF PING-PONG

Convenient for home entertainment is a billiard table with an additional folding top on which ping-pong can be played. It is of regulation size, but "streamlined" to eliminate weight. A rigid surface for billiards is produced without the bulk of the old slate bed. Pockets in each end provide space for ash trays, chalk and paddles. "Twilight," a shade of cloth claimed to be easier on the eyes than green, is used for the top.

CLOSED FIRE TRUCK REDUCES PERIL IN TRAFFIC

Firemen ride inside on cushioned seats instead of clinging perilously to the sides and back, when an inclosed truck in Charlotte, N. C., races to a blaze. Hazards from traffic are reduced and the fire-fighters are protected from the weather. The 750-gallon pumper which looks like a police patrol has places for ten firemen and complete equipment.



Accidents in Traffic Are Cut and Firemen Protected by Inclosed Fire Truck



"Streamline" Billiard Table with Folding Top That Transforms It into Ping-Pong Set Is Latest in Home Amusements

Moon Eclipse Aids Radio

USING radio methods instead of a telescope to observe the July eclipse of the moon, Dr. Harlan T. Stetson and T. S. McCaleb of the Harvard Institute of Geographical Exploration reported that radio receiving conditions were improved when the moon entered the earth's shadow. It is Dr. Stetson's theory that moonlight affects the intensity of radio signals. Even though clouds obscured the moon the scientists reported that signals from Station WBBM, Chicago, were stronger during the lunar event.

Cambridge, Mass

Science Service

7/16/35

Drummond - O'Fallon - Collingdale Co.
629 S. Wabash, Chicago

Mack International
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647 Mr. Herbert Stanley Jadaech
623 Monte Vista Ave
Azusa, Calif

Explosion EXPERTS



A HOLLYWOOD battle scene is being filmed. The powder man sits tense at his keyboard. The signal is given and cameras grind as helmeted figures hurl themselves out of the trenches.

A few, in accordance with instructions, stagger a few steps and fall, others advance heroically as blast after blast is set off. Then machine guns spit and men drop, taking care to "die" in the safe areas. One soldier becomes confused and falls above a heavy dynamite charge. The man at the switchboard sees him and skips a key.

Diagrams Showing Powder Layout to Be Set Off Close to Actor, and One Used in Open; Center, Typical Movie Explosion; Below, This Movie Ship Is Not Afire—It Only Appears to Be

add Thrills to MOVIES



Top, Anti-Aircraft Gun in Action during Filming of Battle Scene; Right, One of the Hundreds of Weapons in the Movie Arsenal



When the scene is over the soldier is called in and the powder man points out the spot where the actor had been. Then he presses the key and the spot flies skyward. The young extra almost faints. But it's all in the day's work for the explosive expert.

Hollywood has a long list of "powder monkeys" many of whom have made definite contributions to the movies. One is Louis Witte, head of the arsenal at Fox Films. When he started, almost all armaments for battle scenes were rented, but he wanted his own arsenal. In ten years he has assembled an arms collection ex-

ceeded only by those found in government arsenals, including over 3,000 small arms, machine guns of aircraft and trench type, sub-machine guns and mortars, and some good sized field pieces. He has expert gunsmiths who can duplicate any type of arm, or remodel old weapons to meet the requirements of a picture. A corps of men is kept busy experimenting with new devices to increase the realism of special effects dealing with fire or explosions.



One of his inventions is a large metal hook that can be closed around a cable or other object and then released by a small powder charge. A shot of a burning building, climaxed by a falling wall is being taken, for instance. The wall is held from above by one of the steel hooks. When the blaze is at its height a director signals, an electrician presses a switch, the powder squib explodes, springs the hook, and releases the wall. The whole thing is almost instantaneous. Perfect timing of this sort saves thousands of dollars and occasionally the life of a player. In the old days the stunt would have been left to chance or to the cutting of a rope.

Occasionally a powder effect of such magnitude is needed that its production on a large scale would be impracticable. The script called for shooting a rocket to the moon in "Just Imagine." A large rocket was constructed, complete even to dummy vents for powder charges. The ground shots were then taken. Later a



Director Telling Movie Sharpshooters Where to Place Their Shots, and the Beginning of a Gun Battle from the Picture, "G-Men"

miniature was made. The powder charges were arranged to project the small rocket into the air, its flight being guided by wires invisible to the camera. After the takeoff and flight of the miniature, the scenes on the "moon" were taken showing the projectile where it was supposed to have landed. The large rocket was used for this. The illusion on the screen was of continuous flight.

Not long ago Paramount took some shots of a beautiful Hollywood home but the action called for burning down the house. So a miniature was built of balsa wood,

and the powder man blew the miniature up when the fire was at its height thus adding to the realism of the scene.

"Slim" Hoffman, Paramount's veteran dynamiter, has been touching off charges for the movie industry for nearly twenty-five years. His first big job was dynamiting to check the flames of the San Francisco earthquake. It was he who handled the explosive work for "All Quiet on the Western Front." To get desired effects he has worked out layouts for explosive plants which



Explosive Expert at Work in Powder Room of One of Movie Companies, and Scene from "Dawn Patrol" as a Plane Is "Shot Down"

by players, Hoffman digs a wedge-shaped channel. He places the dynamite in the bottom, covers it with a layer of dust, then adds a quantity of powdered charcoal and finally completes the cache with a camouflage of material to simulate the surroundings. Such a charge blows away from a player. Rocks and other hard materials are sifted from the plant. If the story calls for rocks or debris, they are made of cork or

balsa wood and placed in the plant. The effect on the screen is realistic and the danger to players is negligible.

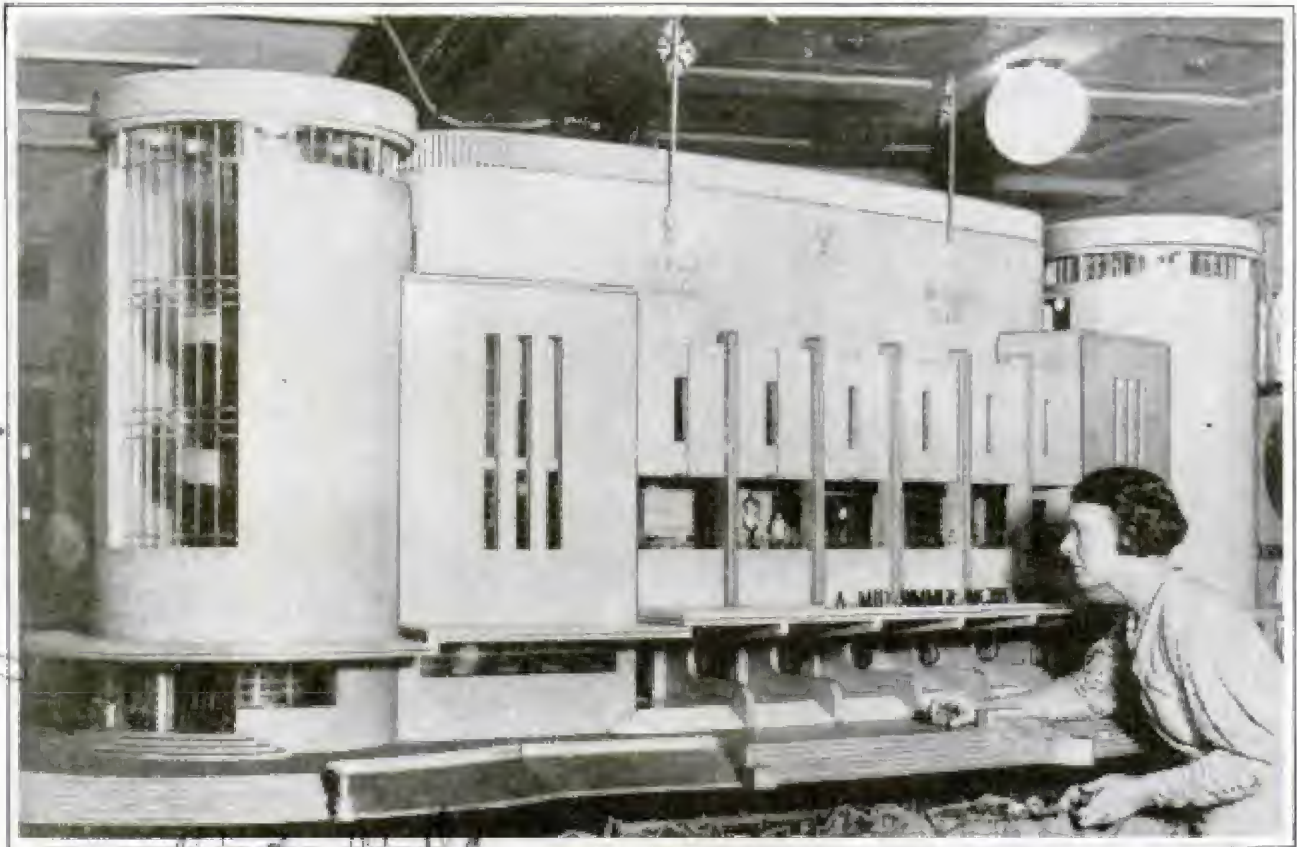
In "All Quiet on the Western Front" the powder man had to blow a coffin out of its grave and have it fall so a soldier could crawl into it to protect himself. The usual safety precautions were taken, dirt was

combine effectiveness and safety to players. For small charges in the open, a cone-shaped hole is dug, powder is placed in the bottom and covered with loose screened dirt. The plant must be exploded within a few hours, for if left long, the dirt packs and makes the charge dangerous.

For charges that must be touched off so as not to damage buildings or injure near-

(Continued to page 132A)

Tiny Figures Stage Show in Model Theater



From Its Revolving Footlighted Stage Peopled with Tiny Figures Playing Shakespearean Scenes, to Its Auditorium with 1,500 Midget Seats, This Miniature Theater in London Is Complete in Every Detail

Complete in every detail to the tiny costumed figures playing Shakespearean scenes behind footlights on a miniature revolving stage, the Silver Jubilee theater model in London has an auditorium with 1,500 midget seats. Five hundred workmen built everything from its ultra-mod-

ern lighting system to its marble-paved foyer and settees in the circle bar. A toy shower bath spouts real water in the star's dressing room. The model is eight feet six inches high and fourteen feet square. It has towers at each end and a lighted sign above the entrance canopy.

Floating Airport Like Arrow Always Heads into Wind



Shaped like a gigantic arrow and so constructed that it would head always into the wind, thus simplifying the landing problem for planes, a floating airport has been designed in model form by E. LeRoy Pelletier, an engineer. His plans call for a mammoth turntable, somewhat in the form of the hull of a great ship, built of concrete and floating in an inclosed basin of water. The airport would move with the changing currents of the wind and provide a stable, yet mobile landing field. It would have a huge ramp around its edges and runways to accommodate a large number of planes and would be adaptable to the sea or inland waters.

Wade World.

"Solid Gasoline" Safer

RESEMBLING a piece of cheese, "solid gasoline" has been developed as a new fuel for airplane and auto engines. It burns slowly and is said to be non-explosive. It is called "solene" and is the invention of Dr. Adolph Prussin. During a demonstration, flaming tracer bullets fired into a five-gallon can of the fuel failed to cause an explosion. Touched with a match, it burns like a wax candle. Solene can be produced from ordinary gasoline at an additional cost of one-half cent per gallon.

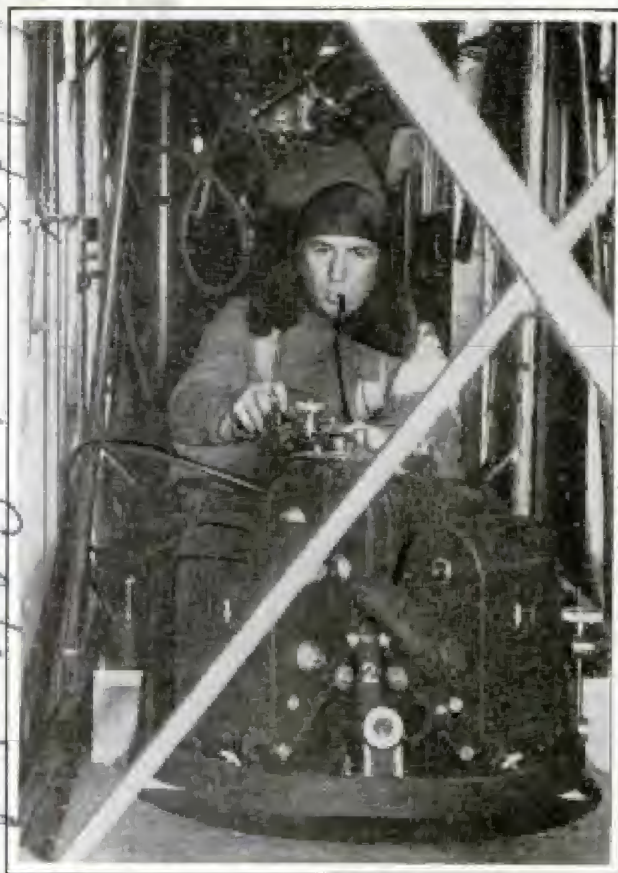
LOOP ANTENNA REDUCES STATIC FOR BIG AIRLINERS

Designed to solve the rain and dust static problem, a new loop antenna is being used on Transcontinental and Western Air transport planes. It is installed on top of the fuselage about six feet from the tail assembly. Eighteen inches in diameter, the antenna is said to be twice as efficient as the regular beacon antenna, so far as reception and signals are concerned. It is claimed to eliminate practically all of the static which formerly interfered with radio communication aboard the ships.



Closeup of Latest Loop Antenna for Airliners

WIDE AREA IS MAPPED FROM AIR BY GIANT TEN-LENS CAMERA



Camera Man, Oxygen Tube in Mouth, Takes Ten Pictures at Once through Plane Floor

Two hundred and twenty-five square miles can be mapped simultaneously from a height of 23,000 feet above the earth by a giant aerial camera just built for a federal soil-erosion survey. Its ten lenses are synchronized electrically. There are two camera units, each with a central lens and four supplementary lenses mounted obliquely, the ten resulting pictures forming an octagonal composite photograph two feet eight inches in diameter. The camera weighs 300 pounds, and each loading of film weighing seventy-five pounds takes 2,000 separate photographs. Six-inch F6.8 lenses are used. One of its first tasks is to map 35,000 square miles of land in the Rio Grande valley of New Mexico for the government, as a preliminary step toward control of erosion in that region.

Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information will be furnished by our Bureau of Information upon request, accompanied by stamped envelope.

William Weber

The Fairchild Aerial Survey, Los Angeles

acme

Across the ATLANTIC in



Control Room of the "Normandie," and Helmsman on the Bridge of the Giant Vessel

Bishop's Rock, official starting point for the north Atlantic race course. A ten-horsepower siren snort announces that she has crossed the mark. Before the reverberations have reached inhabitants in the near-by Scilly Isles, a weather-beaten salt, who has crossed the Atlantic 121 times, cries, "She's off!"

Passengers take up the phrase, "She's off! She's off!" Hereafter minutes count. At thirty-one knots, the cost of fuel alone is about \$6.60 per minute. Besides, there is a crew of 1,300 men and hundreds of other incidentals to pay—a terrific expense.

The four propellers take up a four-day grind. The ship moves forward as majestically as a cloud, as steady as a sidewalk. Begin at the bridge and go down, and you will get a view of what is happening inside this monster as she warms up her muscles.

Captain Rene Pugnet himself is on the bridge. The staff captain and navigation officers are at his side. The lookouts scan the sea. The engine-room telephone and telegraph are buzzing. The ship travels at half speed but one hour after the takeoff,

"ALLO! Allo! Ladies and gentlemen, the Plymouth tender is leaving!"

Every ear on the "Normandie" hears that voice from the ship's broadcasting station. Five minutes later, the Blue Ribbon winner of the Atlantic shifts her bow and faces a 3,000-mile track across a watery waste as an officer writes in the ship's log: "Cleared Plymouth at 7:44 p.m. Moderate swell. Wind south southwest."

Presently the "Normandie" steams past

a BLUE RIBBON Winner



Captain Pugnet orders full speed ahead. Without a sign of effort, the colossus gains her stride like a thoroughbred. When she travels thirty-five land miles per hour, it feels as if she is going no more than fifteen. And nothing short of a major catastrophe can stop her.

The ship's interior is alive with activity. Behind the navigating bridge, as big as a ball-room, the "Normandie's" radio station is establishing telephonic communication between a woman passenger and her husband in Newark, N. J., while a gentleman in the next cabin is putting in a call to Paris. Hundreds



Top, Main Radio Room of the "Normandie"; Below, from This Station It Is Possible for One Man to Control the Two Starboard Engines of the Giant "Normandie," Each One of Them Rated at 40,000 Horsepower



level, but the air is sweet. The engine room is the last place you would expect to find it cool, for haven't we been taught that energy and heat are inseparable? The atmosphere is saturated with the hum of new-born energy but the heat escapes by some miracle. You learn later that twenty-four giant fans make possible sixty complete changes of air every hour! You stand under a forced draft of air coming from the ceiling and it almost blows you over.

The ship's "hot spot" is naturally the boiler room. The burning oil generates a temperature of 1,350 degrees Centigrade, but you find that the room is by no means uncomfortable.

Cool as cucumbers adequately describes the engines. Any one of

of stewards are serving passengers in the great dining halls. Several hundred more are preparing staterooms for the night. Elevators pass noiselessly between decks. Fresh air rushes into every room; foul air is spirited away. The "Normandie" glows like a floating White Way.

What makes all this possible?

To find out you must take the longest elevator ride possible on any ship. You are carried down a 110-foot shaft and deposited in the midst of a wonderland, the "Normandie's" engine room. It is like a vast cave. Below, you have the ship's double bottom, filled with fuel and fresh water. The level of the Atlantic ocean is twenty feet over your head. Outside that thin protective shell of steel, there is an ocean of water waiting to seize you. Water on three sides. You walk below the water



Above, Officer on the "Normandie's" Bridge, Operating Signal to the Engine Room; Below, Fire-Control Room of the Liner

the "Normandie's" four motors can develop 40,000 horsepower, but you can lay your hand on the motor hood without fear of burning. Jean Hazard, the chief engineer, gives you the three golden rules for keeping an engine room cool: First, near-perfect combustion; second, good insulation; third, efficient ventilation.



Heavy Steel Door on One of the "Normandie's" Condensers; This Giant Vessel Has Little of the Brass Found in the Engine Room of the Ordinary Ship

After touring the engine room you understand why the "Normandie's" chief engineer studied the machinery for three years before he assumed the responsibility he now holds. There are tens of thousands of machine parts in this ship. The chief and his assistants must know the position, function, and importance of each one. The ordinary plans which guided the shipyard engineers are scarcely sufficient for them.

The electrified "Normandie" embodies a small world of mechanics all by itself. M. Hazard and his staff set about learning this miniature world as a child would learn about his own country. For three years, the chief and his staff drew maps of wires, pipes, turbines and ventilating ducts, until he could visualize each one in its place.

The "Normandie's" power plant extends three-fourths of the length of the ship and one-third of its height. This is small when you consider that this floating unit not only develops 160,000 horsepower in her propelling engines, but also 12,000 horsepower in the auxiliary engines, which are used for the passenger services. To main-

tain a constant supply of energy it is necessary to burn fifty tons of fuel per hour when the ship is traveling at thirty-one knots; actually, the shaft horsepower at this speed runs up to 165,000. The fifty tons include the oil consumption of the auxiliary engines, which develop 12,000 horsepower, making in all 177,000 horsepower on fifty tons per hour.

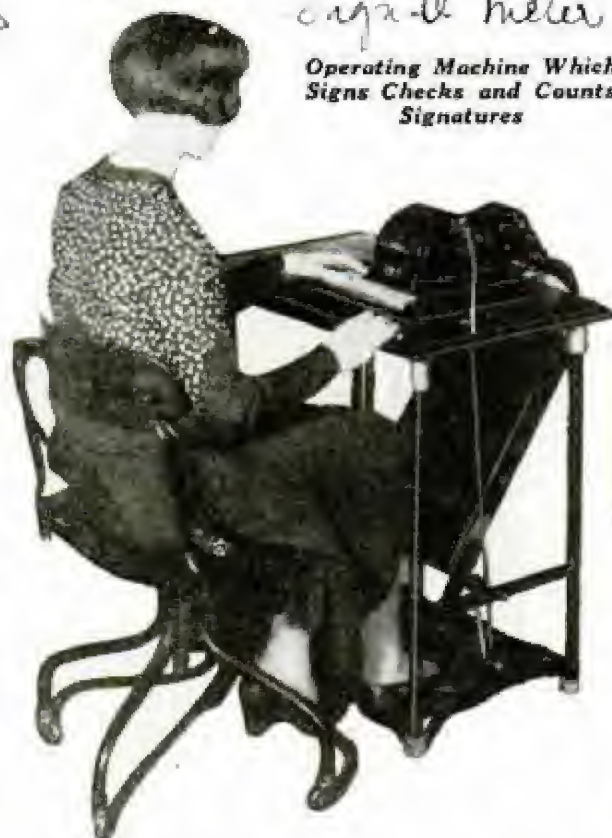
In oil consumption, it is the last few knots which count most. For instance, at twenty-nine knots the "Normandie" consumes only thirty-eight tons per hour and develops 118,000 shaft horsepower; while at twenty-four knots she burns only twenty-four tons per hour. Hence, the last seven knots cost as much as the first twenty-four. To realize the "Normandie's" extraordinary fuel economy, let us compare her with the "Ile de France," a 43,000-ton vessel. At twenty-nine knots the "Normandie" burns as much oil as the "Ile" burns at twenty-three and one-half knots, although the "Normandie's" tonnage is 37,000 greater than the "Ile's."

When the "Normandie" averaged 29.98

(Continued to page 142A)

ROBOT SIGNS CHECKS QUICKLY AND COUNTS SIGNATURES

Chicago
Sign-O-Meter
Operating Machine Which
Signs Checks and Counts
Signatures



Relieving the busy executive of the task of signing numerous checks just before pay day, a new machine not only applies the signature but also keeps accurate count of the number of checks it has signed. The work is done faster than the executive can write. A lock, to which only the owner has the key, prevents unauthorized persons from using the robot. The signature plate is engraved from the owner's signature. In imprinting position, the plate engages a matrix that macerates the signature indelibly into the check paper. In addition, secret marks incorporated into the plate when it is made from the original signature give further protection against forgery and duplication. The marks also make more positive the identification of the signature at the bank.

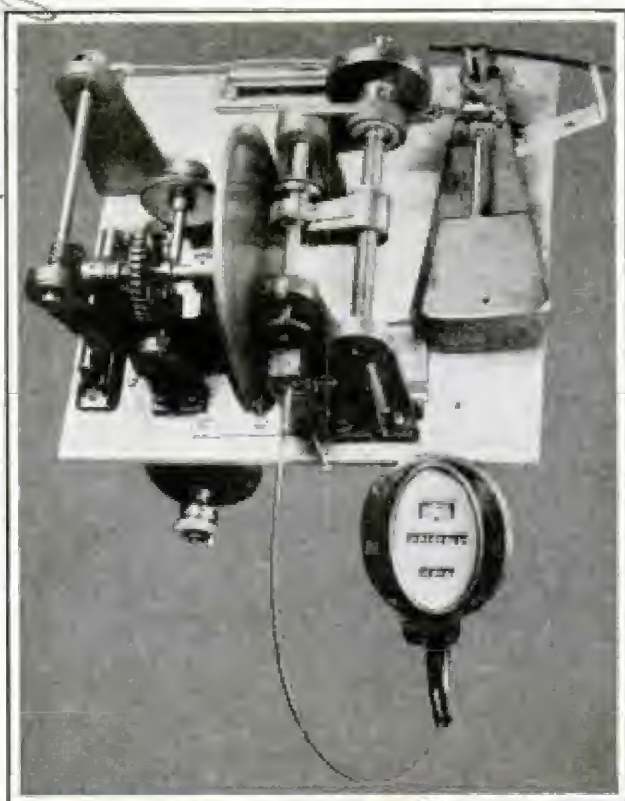
CLUCKING "RADIUM HEN" FINDS ELEMENT WHEN LOST

Radium needles for cancer therapy in hospitals occasionally get lost when not in use. When all other methods of searching fail, the "radium hen" helps find where the lost element is lodged. This instrument, developed in London, gets its name from

the clucking sound it makes when placed near radium. It looks like a garden syringe, but behind its brass-cased head is a neon lamp connected to a cable leading to high-tension batteries. As the instrument approaches radium, the radiation from the element raises the electric pressure sufficiently to light the lamp. The current is then converted into sound, either by headphones or a loudspeaker, which clucks in unison with the flashing of the hidden lamp. The lamp is sensitive to daylight and must be covered when used.

PLANE'S LAND SPEED RECORDED BY PENDULUM INDICATOR

True land speed on an airplane can be recorded in the air by a device that employs the inertia of a pendulum. The pendulum is affected by the speed of the plane when the ship is traveling in horizontal position. Distances traveled in ascending and descending are not registered. A constant speed governor controls the motor which keeps the device in continuous operation during a flight. The instrument, which weighs about twelve pounds, is designed to help pilots determine their position, since it shows actual land speed and distances regardless of head or tail winds.



Equipment Which Records Land Speed of an Airplane While It Is in the Air

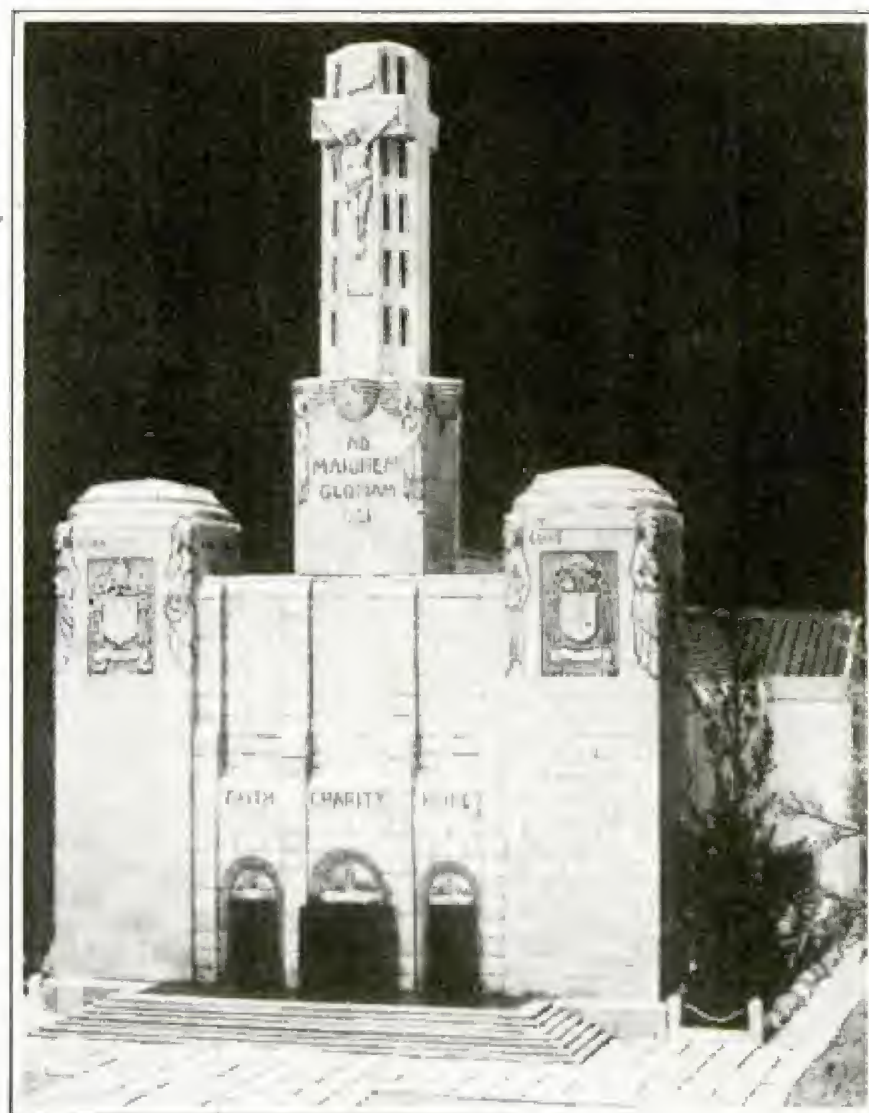
Cl. W. C. A. Richey,
126 W. 8th St. S. D.

8869

Leo Jose, Laguna, Calif

Model Church of Stone Has Organ That Plays

Built on the scale of a quarter of an inch to the foot, a model church made of stone has been constructed by a California man. It is complete in every detail from lighted altars to tiny worshipers in their pews. In the choir loft an organ plays Gounod's "Ave Maria" by remote control. A vested priest stands in the pulpit and red-robed acolytes sit in the chancel. Sacred pictures over the two side altars are illuminated by concealed lights. On the center tower formed by four crosses the figure of Christ crucified is carved. Sculptured heads of the evangelists and saints adorn the four corners of the lower towers while the seals of the popes and bishops are imprinted on the side. So small is the interior that in making the 160 tiny figures in the congregation, the builder had to hold his material in tweezers.



Miniature Church Built of Stone Has Ornate Sculpturing, Lighted Altars, Tiny Worshipers and Organ That Plays by Remote Control

Locomotive with Streamline Shell Is Designed for Speed

Designed to compete with Diesel-electric trains in Germany, a new steam locomotive with streamline shell is capable of

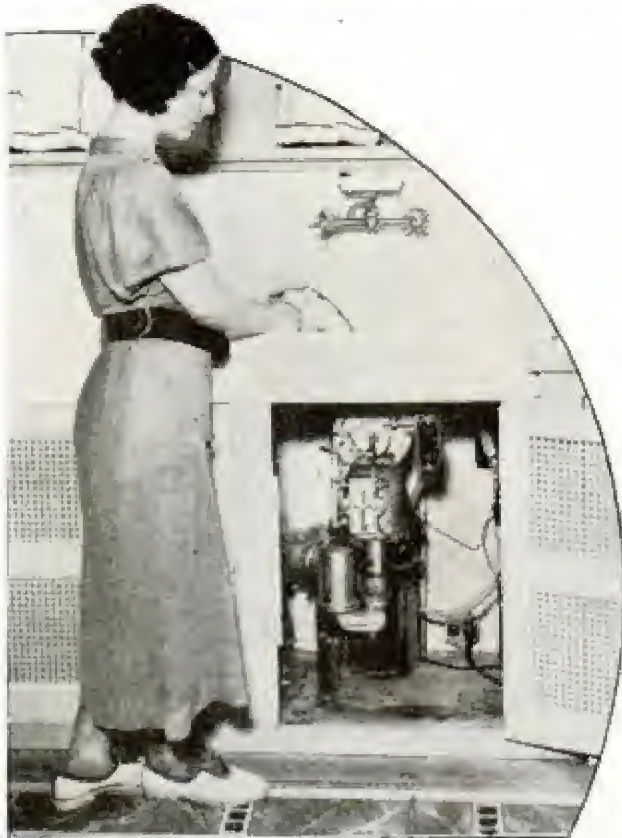
speeds in excess of eighty-five miles per hour on long runs. The lower part of the shell is removable for servicing the drive wheels and other parts. A feature is the concealed stack, which is built within the shell. The locomotive will be used on the railroad operating between Frankfurt on the Main and Berlin.



Our Bureau of Information will answer questions regarding articles in this magazine, if accompanied by return postage.

Henschel + Son, A. S.

KITCHEN GRINDER FOR WASTE DISPLACES GARBAGE PAIL



Electric Grinder Shreds Garbage into Pulp That
Runs Down Drain Pipe

Installed beneath the kitchen sink, an electric grinder quickly reduces garbage into a fine pulp which can be passed through the drain pipe into the sewer system, thus eliminating the garbage pail and solving the problem of the automatic disposal of waste food. By centrifugal action the grinder shreds all types of garbage including bones, but excluding cans and bottles. It is driven by a one-quarter horse power electric motor.

WHIRLING FAN FITS IN POCKET WHEN NOT IN USE



Weighing less than two ounces and resembling a windmill, a tiny fan operated by clockwork has blades that fold automatically together when the mechanism is stopped. The rotating blades de-

scribe a circle four inches in diameter and can be touched without injury. Folded the fan is one and one-half inches wide and two and one-half inches high. Held in the hand, it creates a strong current of air, which is effective within a radius of about eighteen inches. Blades and housing are made of Bakelite.

RADIO "LISTENS" TO CYLINDER TO CATCH HIDDEN DEFECTS

Tests to determine whether cylinders of rotary compressors are centered and adjusted properly and to detect any other microscopic irregularities are being made with a radio receiver with headphones connected to the machine, by a Cincinnati factory making refrigerators. After the parts have been measured with micrometers gauged to the ten-millionth part of an inch, they go to this radio for final tests. A cylinder off center by the most infinitesimal fraction reveals its error by



Sound Tests of Refrigerator Cylinder by Radio Receiver Reveal Hidden Defects

changes in sound as it revolves around a concentric stud. By listening at the ear phones the inspector can detect faulty adjustments that the most delicate measuring instruments do not reveal.

Oil Port Can Service City of Half a Million

Facilities for handling more than 250,000,000 gallons of petroleum products each year are provided in the oil port opened on Staten Island near the heart of New York City, by the Socony Vacuum Oil company. Covering 257 acres, the terminal will be able to unload and transship the oil from 100 ocean-going tankers and scores of barges annually. In spite of its size, only a small force of workers is needed for operation and maintenance. Its thirty-nine giant storage tanks have a capacity of 46,018,000 gallons; 10,000,000 gallons of gasoline, enough to run an automobile 150,000,000 miles; 26,000,000 gallons of oil fuel, sufficient to heat 17,000 homes for twelve months; 10,000,000 gallons of burning oil, enough



Left, Tanker Unloading Petroleum at Mammoth Oil Port in New York City That Has Facilities for Accommodating Hundreds of Craft Annually; Above, Part of Terminal's Extensive Pipe-Line System

to provide five days fuel for New York, London and Paris, and 18,000 gallons of lubricating oil. On an annual basis, the capacity of the port is sufficient to meet the needs of 85,000 families or a city of about half a million. Three big tankers and eleven barges can occupy the 2,000-foot steel bulkhead at one time. Ten miles of pipe connect the tanks with unloading

and loading platforms. The fire-fighting equipment includes fresh and salt-water pumping machinery, pipe lines and a foamite system. The oil company's sea-going fleet using the port comprises 800,000 tons and exceeds the size of many a foreign navy. It transports 45,000,000 barrels of oil products annually. On inland waterways the company operates 186 craft.

Cont. from Esplanade, 4 W. 103rd St. New York

Double-Deck Train Carries

Twice as Many Passengers



This Odd Looking Coach Has Two Decks to Carry Twice as Many Passengers, Yet Its Height Is No More Than Ordinary Car

Carrying twice as many passengers as trains of conventional design, double-deck railroad cars are being used in suburban traffic in Paris. The cars are all metal and of regulation height. The lower deck is built low, on a level with the station platform, with a flight of steps leading down to it. Another flight of steps leads to the upper deck, which is roomy enough for a man of normal height to walk.

"RAINCOAT" FOR WET FOOTBALL MAKES IT EASY TO HANDLE

Costly fumbles on wet football fields are eliminated by a rubber "raincoat" devised by Arthur,



"Dutch," Bergman, coach at the Catholic University of America, Washington, D. C., which encases the ball in stripes laterally, leaving most of the surface exposed. It weighs about two ounces and cannot slip after being

fitted on. Dampness enhances the player's grip on the ball's surface. It is being adopted by other coaches for rainy-weather practice and may eventually be used in regular games when the weather is inclement.

OIL DRIVES AUTO FITTED WITH PIPE SYSTEM

Intended to permit the use of fuel oil in any automobile without major changes, a simple system of pipes has been tested on the road. The system runs from a special tank containing the fuel oil, passes several times around the exhaust pipe and attaches to the carburetor. Wrapping the fuel line around the exhaust pipe is said to cause pre-heating of the oil before it enters the carburetor and mixes with water vapor from the radiator. The car is started on gasoline in the usual manner, warmed up and then changed over to fuel oil by turning a two-way valve controlled from the dash. Before stopping, the driver switches back to gasoline to clean out the carburetor and permit easy starting. Two to ten more miles per gallon, plus the saving between the cost of gasoline and that of fuel oil, are claimed.

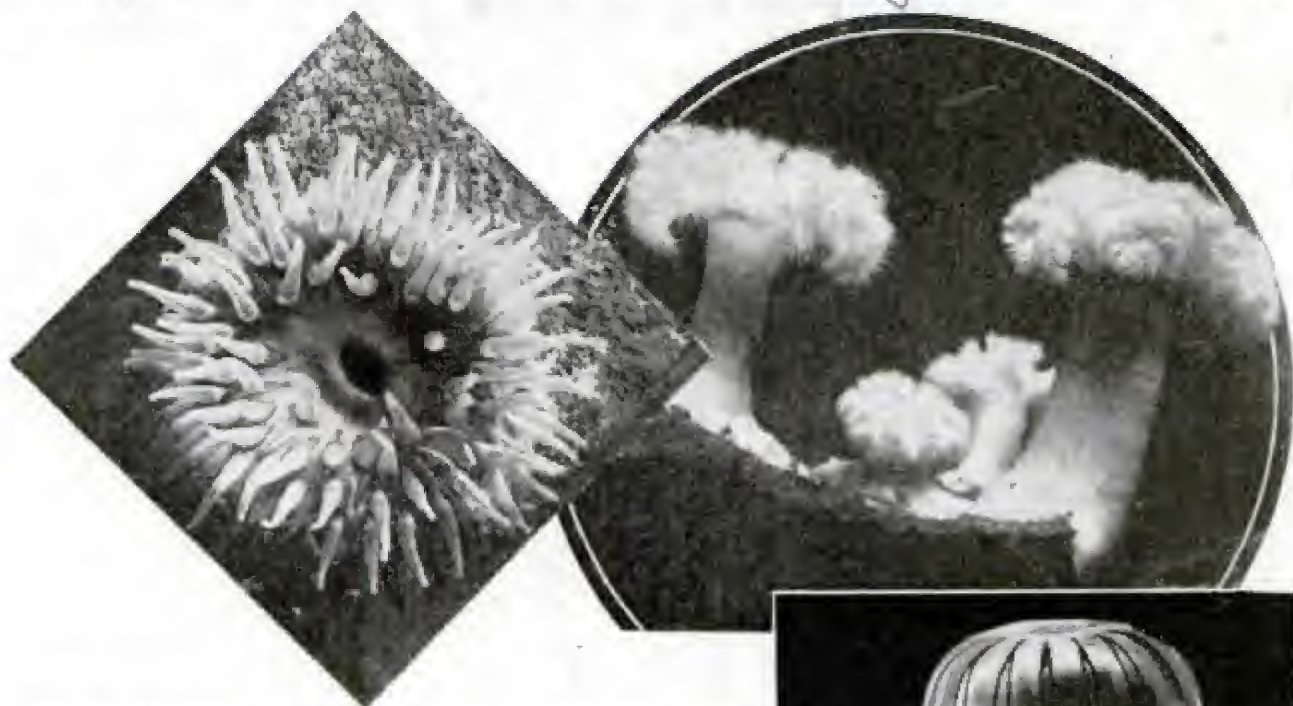


Inventor Points to Pipe System Designed to Convert Auto to Burn Oil

still available..

7/3/41

Deep-Sea Animals Rival Flowers in Beauty



At the Bottom of the Sea, the Plants Are Animals; These Photos Prove That Those Strange Water Creatures Rival in Beauty the Choicest Products of the Greenhouse and Cultivated Gardens on Land



Among the Flower-Like Animals of the Deep Sea Are: Top, Left, the Tealia, Sometimes Called the Sea Dahlia; Woe to the Smaller Animal That Is Attracted by Its Gorgeously Colored Tentacles; Top, Right, Sea Anemone of White, Gray or Delicate Pink; Bottom, Left, Widowed Sea Anemone Which Resembles an Exotic Plant; Each Tentacle Is a Poisonous Barb That Kills Smaller Creatures; Right, Compass Jellyfish, Resembling an Onion, with Floating Veils of Unusual Beauty and Coloring

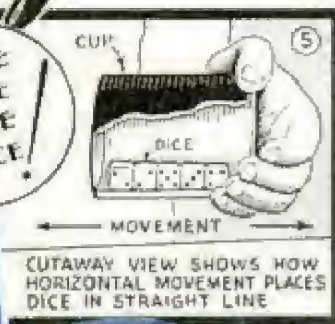
8692.

Chas. Sam. Brown
151 Carhart St.
Marion, Ohio

You Can't Beat



HERE ARE THE DICE!



ing all numbers. Yet the house is the winner just as frequently as the house wants to be the winner.

The answer is very simple—loaded dice. The loading has very little in common with a chunk of lead planted on one side of the dice—the average man's idea of loaded dice—but is so cleverly done as to be almost undetectable. Gold, platinum and amalgam fills are used, the load usually being placed in the spots, which are

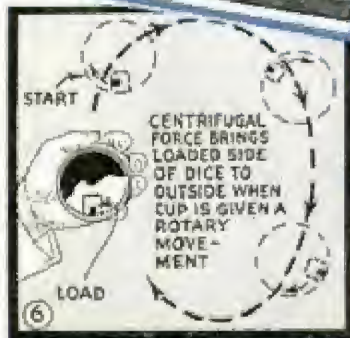
TODAY many places will gladly roll dice with any and all customers, pay nothing or pay double. The game has a thousand variations. You better beware of all of them. One of the most popular calls for five dice and a leather dice box. The aces are wild, that is, the one-spots can be called any number. A player must show an ace in order to start scoring.

The highest hand which can be made is five aces. Next comes five sixes, then five fives and so on. Suppose there is no ace to start the scoring on your first roll and your second shows 5, 1, 3, 3, 2. You have an ace and two threes. The hand can be called three threes in two rolls, and your opponent is allowed the same number of throws. However, the remaining two dice can be tossed again, say, for an ace and a five. The ace is called a three, making the hand four threes in three rolls. Three rolls is the limit, and the dice then go to the next man.

A simple game. The houseman and the customer use the same dice and the same cup. The dice look and roll natural, show-



THIS LINES THEM UP!



THIS MOVE BEATS YOU!

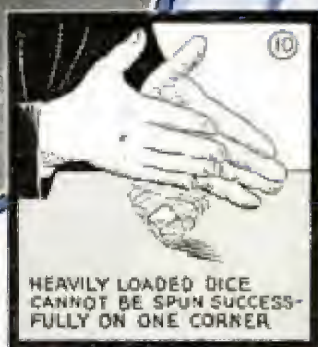
How Loaded Dice Are Manipulated in Cup to Bring Up Winning Numbers

reamed out a fraction of an inch deeper than normal to take the metal. The fill is often no larger than a grain of sand, and cannot be detected even in transparent dice. For bets, the usual combination is ace and five. Since opposite sides of the dice always total seven, this means that the two-side and the six-side of each die is loaded to bring up the opposite sides—ace and five.

Now, watch the dice in actual play. Toss them on the table. They show all numbers since the load is not heavy enough to have any marked effect. They spin on any corner without signs of wobbling. The



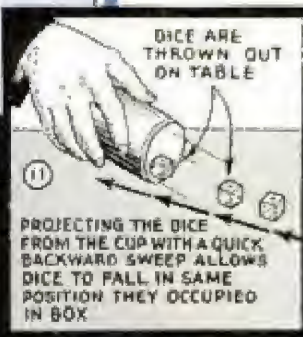
Dropping Dice in Water Shows If Sides Are Treated to Favor Certain Numbers



HEAVILY LOADED DICE CANNOT BE SPUN SUCCESSFULLY ON ONE CORNER



Five Aces!



PROJECTING THE DICE FROM THE CUP WITH A QUICK BACKWARD SWEEP ALLOWS DICE TO FALL IN SAME POSITION THEY OCCUPIED IN BOX

The "Dump Shot" Used in Releasing the Loaded Dice from the Cup after the Rotary Manipulation

customer and the houseman use the same dice. How, then, does the house have the advantage? The answer is told in the pictures. Figure 1 shows the start as the dice are dropped into the cup. Figures 2 and 5 show how a horizontal shaking of the cup lines the dice up in a straight line, a necessary position for any manipulation. Fig-

ure 3 is the important movement. This is a rotary swing of the cup, a movement with a host of variations never noticed in actual play. The rotary movement, by centrifugal force, tends to turn the dice so the loaded side will come to the outside of the cup, as shown in Figure 6. In the hands of an expert, the dice will now be in a straight line, with either aces or fives up. It is simple to dump them with a quick backward sweep of the cup, as shown in Figures 4 and 11, so that they will slide out on the smooth surface of the table without turning over. Naturally, the experienced player varies his technique, and the house uses several sets of differently loaded dice which are substituted from time to time. Any of these sets can be controlled by the house player; in the hands of a casual player they will show all numbers without any apparent favorites.

Loaded dice are difficult to detect. Twenty-four-gauge gold fills are so light that the die can be successfully spun on



Diagram of Operation of Electric Dice, and Detecting Electric Dice with Magnet; Right, Test for Suction Dice

any corner. These dice can be dropped into a glass of water without detection, but heavier loads will invariably bring up the numbers for which the dice are treated, as shown in Figure 9. The only real test of loaded dice calls for special balancing calipers. Other crooked dice of similar appearance but treated differently are often used together with two or three loaded dice to make up a set. Working in this manner, the house can prove by balancing, caliper, spinning and other tests that the dice are fair. One of the set, not loaded, but shaped to show a percentage, can even be burned or cut apart to show the dice are not loaded.

All crooked dice are not loaded. There are many ways by which the house obtains a heavy percentage without loads. Shapes, trip edge, suction dice, electric dice, capped work, floaters, horses and other descriptive terms mean nothing to the outsider, but guarantee a percentage to the man who knows what they are and how to use them. "Shapes" are dice with certain sides filed off about five-thousandths of an inch. Thus, certain sides are wider than others, the dice tending to settle, through proper manipulation of the

cup, on the broad sides. The same treatment is used on celluloid dice by dipping them in boiling water and then squeezing them in a vise to obtain the desired "broad" or "flat." Banana oil and ether applied by brush and fingers change the chemical composition of the dice, and give the same percentage as a light load. Certain sides are often capped with a thin layer of special non-slip material. This is vulcanized in place and is invisible, but shows a strong percentage when the dice are used in a cloth-covered cup. A similar percentage is obtained by making cer-

tain sides slightly concave so these sides will tend to come face down by the suction they create. A simple chalk test to show the "work" on this kind of dice is shown in Figure 14. In another set, certain edges are sharp while others are slightly brushed or rounded, the result being a tendency to roll more easily to a winning number and stay there. "Tapping

dice" have a sliding load which can be set for any number by holding the desired number face up and tapping the dice on the table before tossing them into the cup. "Tops and bottoms," or "horses," are dice which do not seven. They may have two aces and two fives, and get by because only three sides are visible at one time.

Electric dice are controlled by magnetism. Figure 13 shows how they are operated. Here, again, the load is cleverly balanced so that the dice roll and act natural, slightly favoring the non-winning lead-loaded side when the current is not on. When the current is on, the magnet below the table pulls the iron load down and the dice show winning numbers. The transparent dice have metal fills in the spots. They are positive in action when sufficient power is used, but are not as fast as the fully loaded bone dice. Magnets concealed within a counter-case humidifier are popular for glass-topped show cases, and the batteries are usually con-



cealed under the floor. Alternating current can be used with a transformer. The magnet works through wood or glass just as well as through any other medium, and powerful outfits can be concealed beneath the floor and still control dice thrown over a wide territory on a wood or glass counter above. With rheostat and mercury switch control, electric dice are smooth, silent and undetectable in operation—the most dangerous of all crooked dice.

DISK CALCULATES TIME FOR ANY SPOT ON GLOBE

Consisting of two cardboard disks fastened together so they may be turned in either direction, a handy time calculator is available for those who find it necessary to determine quickly the time at any point on the earth. By setting the calculator at the proper time in the city or time zone where the user is, the time at distant points appears. Directions for operating the calculator are printed on its face.



By Manipulating Disks Properly, Any One Can Determine Time at Distant Points

ch. and info.
W. B. Caldwell



Top, Tourists Have Set Up Penthouse for Night on Road with Side Awning Raised to Shelter Cot or Table; Bottom, Penthouse Packed for Travel

LIGHT "PENTHOUSE" FOR TOUR EASILY MOUNTED ATOP CAR

One person can easily "make up" for the night a lightweight "penthouse" on the roof of an automobile, sheltering a double bed for tourists. The process of making up requires only five minutes. The frame is of aluminum, durable and light, firmly strapped to the car body yet nowhere in direct contact with the automobile. It can be lifted on or off the car top in fifteen minutes by one person. The bed rests a few inches above the roof, and over it is raised a tent resembling a covered wagon. Dressing room is at the rear, with luggage space for hanging garments at full length and room for storing cooking equipment, dining table and other camping furniture. Cabinets are of ply or laminated wood. At the side an awning can be raised to shelter additional cots or table and chairs. Built compactly, it does not hamper highway travel.

Sent in by Automobile
Test Laboratories, 4600

price less than
\$200.00

J. Wilbur Jackson, 933 Towner
Road, Winnetka, Ill.

Libby, Clemons, Gold, Glass Co *Bryan and Warman &* Tempered Glass Bends Without Breaking *Islede Glass*



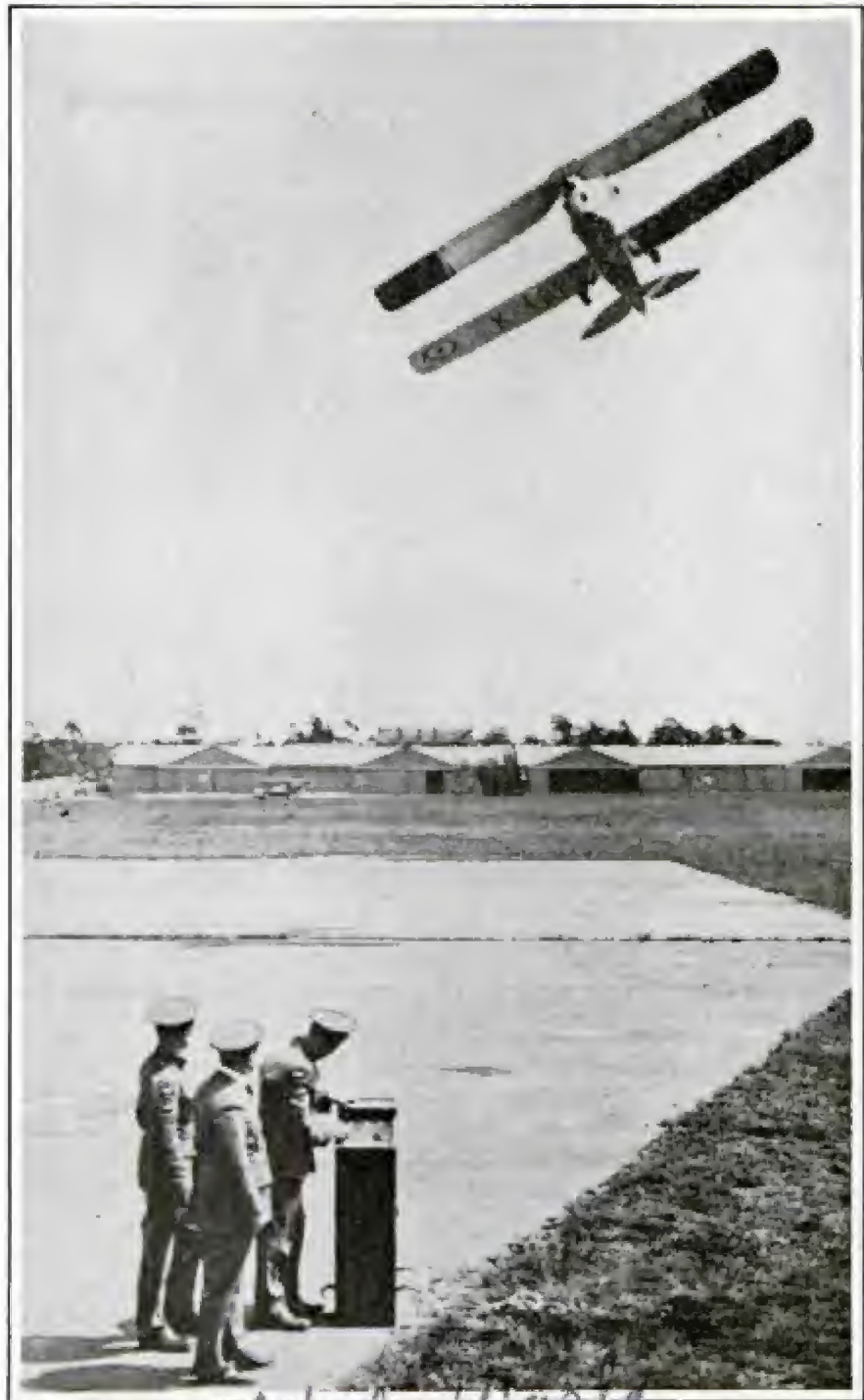
Top, Tempered Glass Supports Weight of Two Girls; Left, Center, under Severe Strain It Crumbles; Right, It Is Impervious to Ice or Molten Metal; Below, Twisted Twenty Degrees without Breaking

All-glass houses fitted with unbreakable glass furniture have been brought a step nearer by the development of a tempering process which increases the strength of ordinary plate glass six times. The glass is heated in a specially designed electric

furnace until it is almost plastic. Then it is cooled suddenly with blasts of air, creating high strain. This process develops high compression on the outer surface, while the interior is under pressure in the opposite direction. The result is a glass

impervious to ice or molten metal, that can be twisted twenty degrees out of shape without damage. It resists shocks that would shatter ordinary glass and if broken under severe strain will crumble into small particles like pebbles, instead of breaking into jagged slivers. In one laboratory test a two-pound steel ball and an eleven-pound sack of shot were dropped from a height of six feet onto a quarter-inch sheet of the tempered glass without injury to it. The glass is made to the exact size required. It cannot be cut on the job, because a puncture with a cutting tool causes crumbling. It has the same clarity as plate glass and can be produced in a variety of colors which are fire-glazed on it during the strengthening process. It can be used in building all-glass gasoline filling stations and pumps, for port holes in ships, diving bells, observation windows in steel-mill furnaces, structural glass for building, thermometers exposed to extreme heat, glass-inclosed basket ball and handball courts, glass observation doors in kitchen ranges, transparent table tops, tropical-fish aquariums and colored fireplaces for the home. While the tempered glass crumbles, instead of slivering, like ordinary glass when broken, it is not intended to be used in automobiles or windshields in the place of safety glass. The latter remains intact in its frame, even though badly cracked, while the tempered glass crumbles.

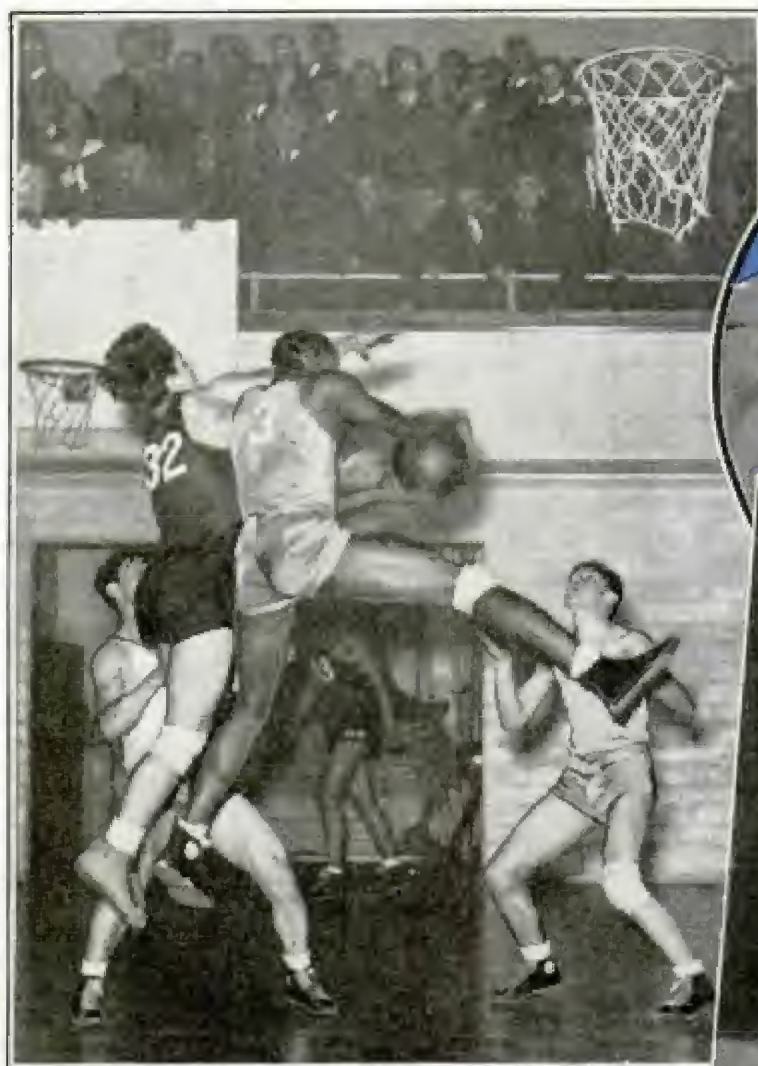
Our Bureau of Information will answer questions regarding articles in this magazine, if accompanied by return postage.



Which World
Airplane Taking Off under Remote Control of Ground Officer, Seen Pressing Keys of Radio Board Which Guides Pilotless Flight

RADIO CONTROLS ROBOT PLANE ON PILOTLESS FLIGHT

Flying a plane without a human hand on the controls from takeoff to landing was demonstrated recently when a Royal Air Force ship was maneuvered by radio at an English airport. The "Queen Bee," as the pilotless plane has been named, operated perfectly under remote control within a radius of ten miles from the airdrome. An aviator was in the cockpit, but he did not touch the controls.



Split-Second PHOTOGRAPHY

ONE of the most sensational news photographs of recent years never would have been made had inventors not opened a new era in photography by developing "bottled lightning." The picture showed the late Mayor Anton Cermak of Chicago being supported by two friends just after he was shot at Miami.

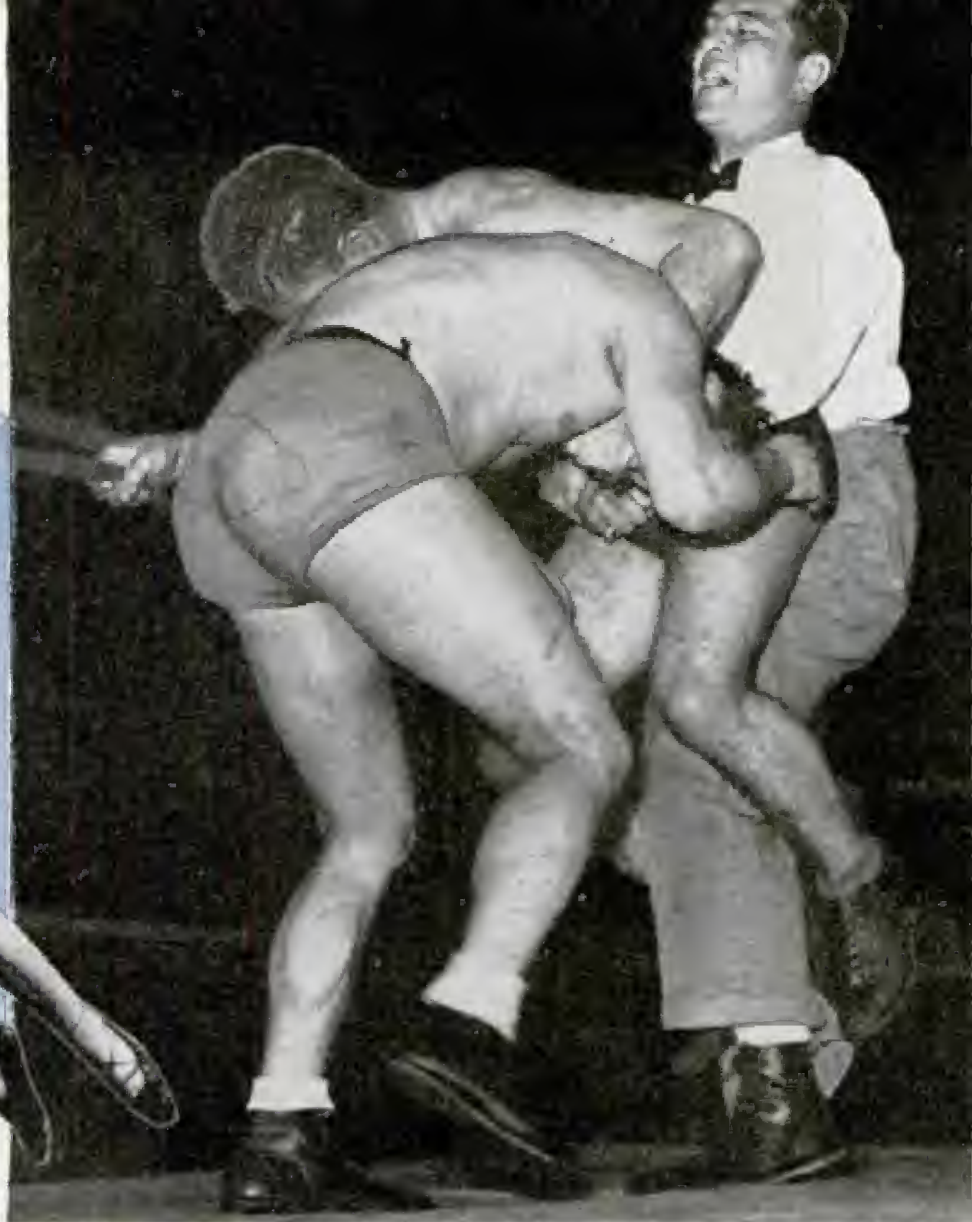
A news photographer was standing near Mr. Cermak when the assassin's gun cracked. Almost before anyone realized what had happened, the photographer snapped a picture that made history. This occurred at night. The feat seems impossible until you are told the camera was equipped with a photoflash synchronizer.

The introduction of the photoflash lamp revolutionized photography under difficult light conditions. It has been made more effective by equipment enabling the cam-

Night Shot and Basket-Ball Action Made with Synchronized Flash; Top, Camera with Synchronizer

era shutter and photoflash bulb to wink in unison, so action can be photographed at any shutter speed, regardless of natural lighting. This winking is accomplished by synchronizers or speed-flash guns.

Many of the stirring action pictures you see in your daily paper were made with the aid of speed-flash guns. This method



with Bottled LIGHTNING



Speed-Flash Action Shots, and Type of Synchronized Camera Used by Many Newspaper Photographers in Getting Action Pictures

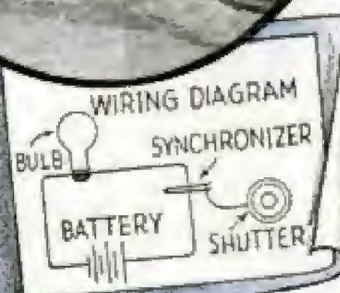
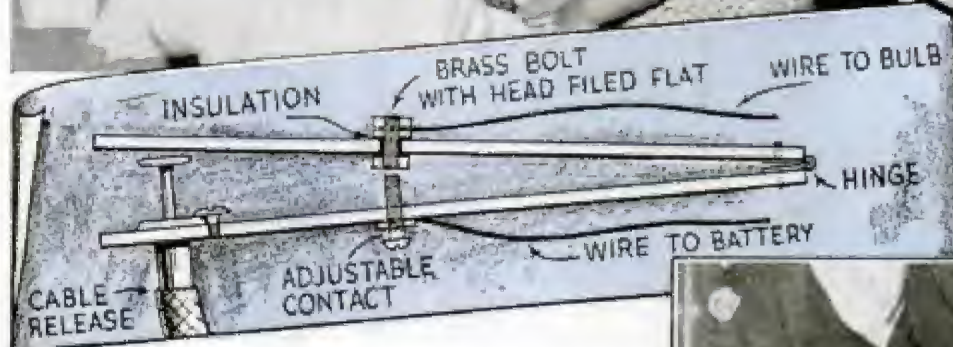
also is used to produce many of the commercial black-and-white and natural-color advertising pictures. Sometimes as many as 600 photoflash lamps are fired at the same instant. The speed-flash method removes the danger of blurring because of movement, and provides a more convenient method of obtaining desired lighting effects.

Amateur photographers are using speed-flash guns more and more. There is no more fascinating or effective way to get spontaneous realistic pictures of children, parties, sports or any other subject involving action.

A photoflash lamp, aptly termed a bottle of lightning, consists of a glass bulb like that of an ordinary electric lamp. Inside it is oxygen and, loosely packed, some very thin aluminum foil. Two wires lac-



Synchronized Flash Pictures, and Photo and Diagram of Simple Semi-Synchronizers Anyone Can Make



quered to insulate them from the foil, project into the center of the bulb; and across them stretches a short filament coated with a substance that gives off a shower of sparks when the filament is heated by electric current.

When a current of 1.5 to 125 volts is passed through the filament, the foil, being surrounded by oxygen, burns almost instantly. The temperature rises to a high point, and the light emitted is even stronger under some conditions than sunlight. A lacquer coating inside the bulb prevents the glass from shattering.

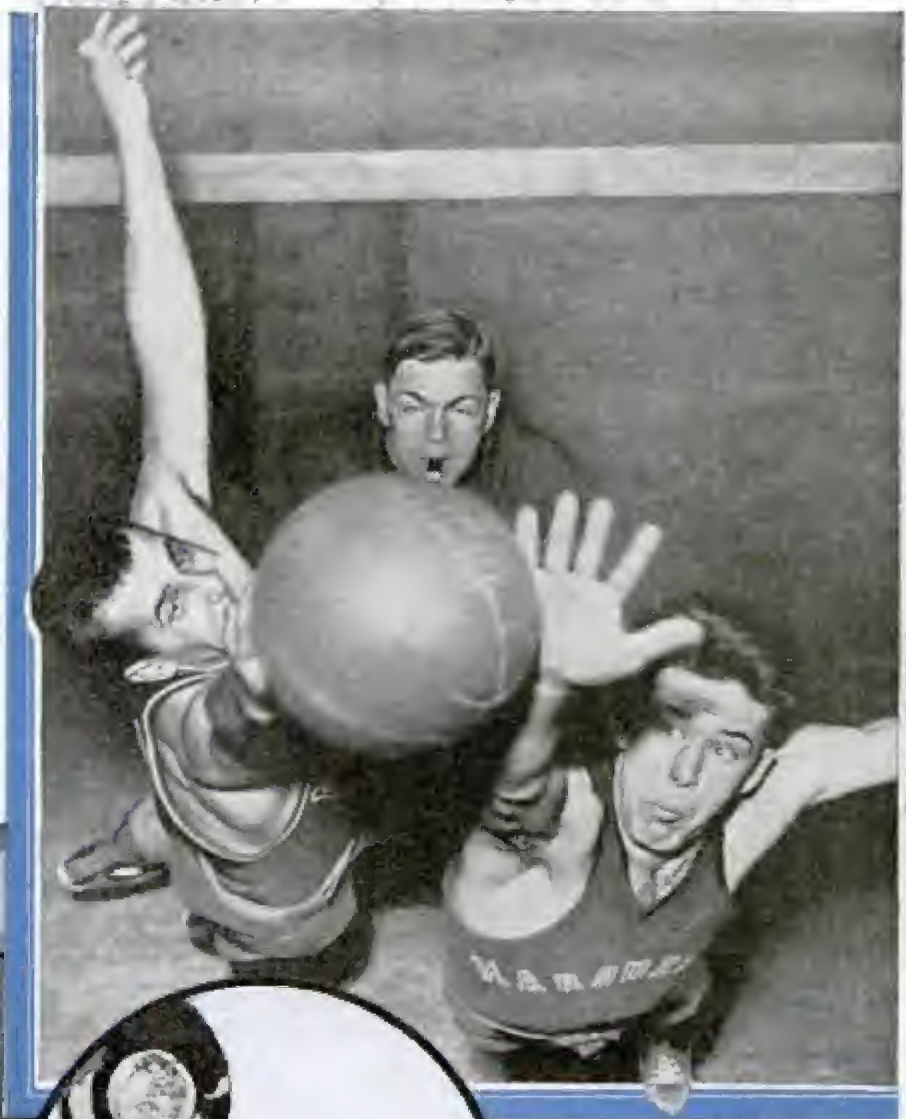
The time required for the foil to burn depends on the quantity. Three sizes of bulbs are made. One produces a flash of one-seventy-fifth second duration, another about one-fiftieth second and the largest, one-twenty-fifth second. A fourth bulb, the same size as the second, has a deep blue inner coating which removes the visible yellow, orange-red and red rays of light, letting only blue, green and ultra-violet light pass. The speed of this bulb is one-one-hundredth second. It is used where the sudden bright flash of the



ordinary lamp would be objectionable, for its flash is almost invisible to the eye.

Making an exposure, using the bulb speed alone, consists simply of opening the shutter, flashing the light, and closing the shutter. Photographers soon discovered

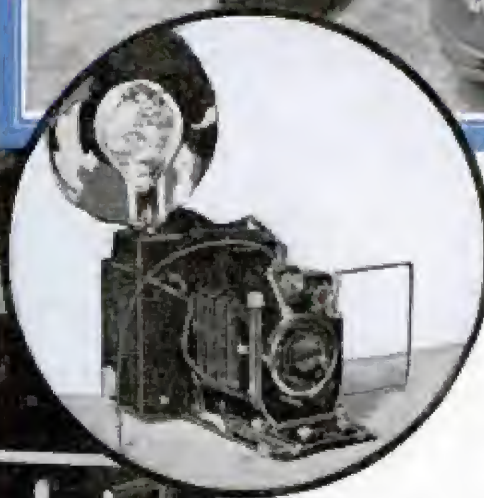
they could not always open and shut the shutter rapidly enough; sometimes they failed to fire the flash while the shutter was open. So there appeared various devices for firing the bulb at the instant the shutter opened. Most of them consist of a fitting attached to the shutter or shutter-release cable, adjusted so that, when the shutter is set for a time or "bulb" exposure, the lamp will fire at the proper moment. Thus, with the camera shutter set on the bulb adjustment, pressure on the trigger



Sports Pictures Are Easy with the Synchronized Flash; One Outfit for Making Them Is Shown

will open the shutter and at the same instant fire the photoflash. Releasing the pressure closes the shutter. Such devices might be called semi-synchronizers.

The true synchronizer or speed-gun is more complicated. It sets fire to the aluminum foil in the lamp, then trips the

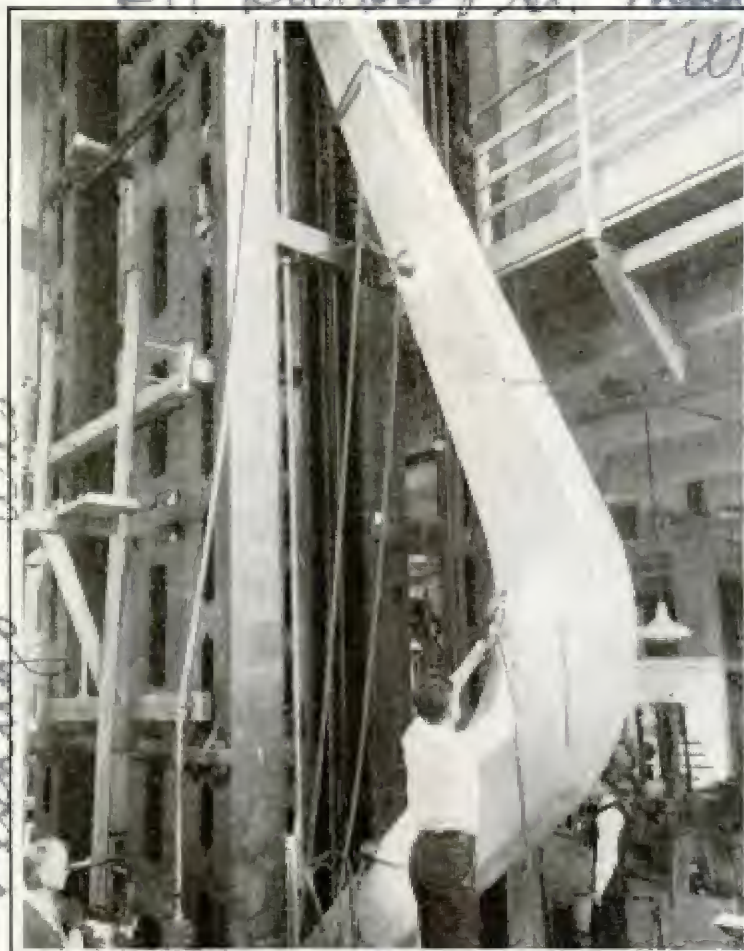


shutter at the instant the foil is burning most brilliantly, all in the space of one-fiftieth second or so. The average photoflash lamp requires about .012 second to start firing after the current is applied. Then the foil burns for another .070 second. The

most intense illumination is produced about .020 to .023 second after the current is applied. It is the synchronizer's job to snap the shutter, which may be set on any speed up to one-two-thousandth second, when the most light is being produced.

Speed-flash guns are of two types, magnetic and mechanical. In the magnetic type, closing a switch sends current through the lamp filament. Then, at the proper instant, a magnetic relay attached to the shutter presses the release trigger. The synchronizer is adjusted during man-

(Continued to page 122A)



Testing All-Wood Arch in Laboratory to Demonstrate Its Adaptability to Many Uses of the Modern Builder

WOOD ARCHES FOR BUILDING FOUND STRONG AND CHEAP

Built-up glued arches of wood have been found strong, durable and economical for buildings where wide areas of unobstructed floor space are necessary. Two types, one the double I-beam and the other solid and made of built-up layers nine-sixteenths inch thick, constitute the main framework of a test building erected by the U. S. Forest Products laboratory at Madison, Wis. Completed arches are covered with wall and roof panels with plywood surfaces. Thus, a modern building can be constructed entirely of wood except connectors, plates and bolts.

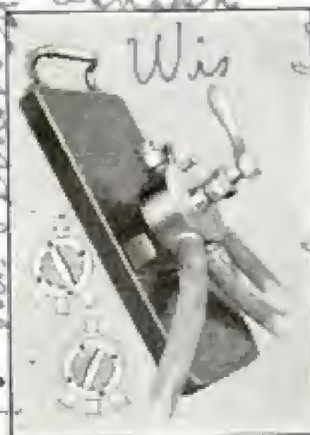
"DRY ICE" WELLS CAN SUPPLY THOUSAND TONS PER DAY

Stored hundreds of feet beneath the Salton sea basin of southern California, a deposit of carbon-dioxide gas estimated at 35,000,000,000 cubic feet is waiting to be turned into solid Dry Ice, according to a

report of the American Chemical Society. Vast new possibilities for the cheap refrigeration of fruits and vegetables shipped from California and for air conditioning and domestic refrigeration as well may be opened up by the development of this field. The gas is tapped from wells starting at 200 feet below sea level. It takes approximately 35,000 cubic feet of carbon-dioxide gas to produce a ton of Dry Ice, so the potential output is 1,000,000 tons. One location on Mullet island alone, geologists say, may yield 1,000 tons a day. It is estimated that the cost of production will be lower than usual, since the natural pressure of 230 pounds per square inch in this area reduces the artificial pressure required to transform the gas into solid Dry Ice. The Salton sea gas yields from 99.1 to 99.6 per cent pure carbon dioxide, a very high average.

TWO-WAY FLUSHER CLEANS RADIATOR BETTER

At a turn of a lever, the flow of water in a new auto radiator flusher can be reversed, resulting in a better job of cleaning out the cooling system. Air pressure is used for the upward flow, a connection being made to the garage air-pressure hose. The flusher has a red hose for the up flow, a black one for the down flow and a green hose for connecting to the radiator. Various sizes of adapters can be supplied to fit any radiator hose connections. The machine is attached to a hardwood base that fits on the car fender while in use.



Twelve speeds are provided in a British made bicycle on which the gears are controlled by twist grips on the handlebars.

Cycle Iscar Co.
Patterson Hill Astoria

made by Gait Structures, ches
Resistor Wis

964 Am. F. A. Storage Service
211 Lathrop St. Madison Wis

7/18/35

Wallo
Newport

E 762

5/26/35

E 845

P. from Johny speaking of 5/26/35
Sunday

Pusher-Type "Flivver" Plane Easy to Control



Two Views of Pusher Plane That Can Be Landed in Small Space; Its Designer Claims Unusual Ease of Flying

Designed to prevent nosing over, the latest "flivver" plane has a pusher motor. It is of metal construction, with fabric-covered wings. The ninety-five horsepower engine is mounted at the rear of the two-place cabin. Two of the three landing wheels are placed behind the center of gravity, the third under the nose to give great stability in landing. The inventor says that anyone who can drive an au-

tomobile can fly the ship. It lands safely from any altitude when the control lever is held in back position. The plane comes down in a steep glide, dropping almost as safely as a parachute, and needs only 100 feet for stopping after its wheels touch the ground.

Rubber Block for Sandpaper Useful on Curved Surface

Curved surfaces can be sandpapered as readily as flat ones when the sandpaper is fitted on a soft rubber block. A sanding block of this type is now being manufactured, with a locking arrangement that keeps the paper firm. The sheet is placed under the rubber block, sand side out, and each end folded up and inserted in a slot formed by lifting the "wing" top of the block. When the top is pressed down, the sandpaper is clamped on small nails and snugly locked in place. The rubber block is easily gripped in the hand.



Minnesota Mining & Mfg. Co.
797 Forest St. St. Paul, Minn.

Blaze of Color to Mark Paris' World's Fair

When Paris Opens the International Exposition in 1937, Visitors Will Find the Ninety-Acre Site Replete with Surprises; Buildings Will Be a Harmony of Colors by Day and Ablaze with Illumination by Night; Lighting Alone Will Cost \$2,000,000; Prefabricated Buildings, Made Outside and Merely Bolted Together on Their Site, Are Planned, and Islands Will Be Built in the Seine River for Exhibits

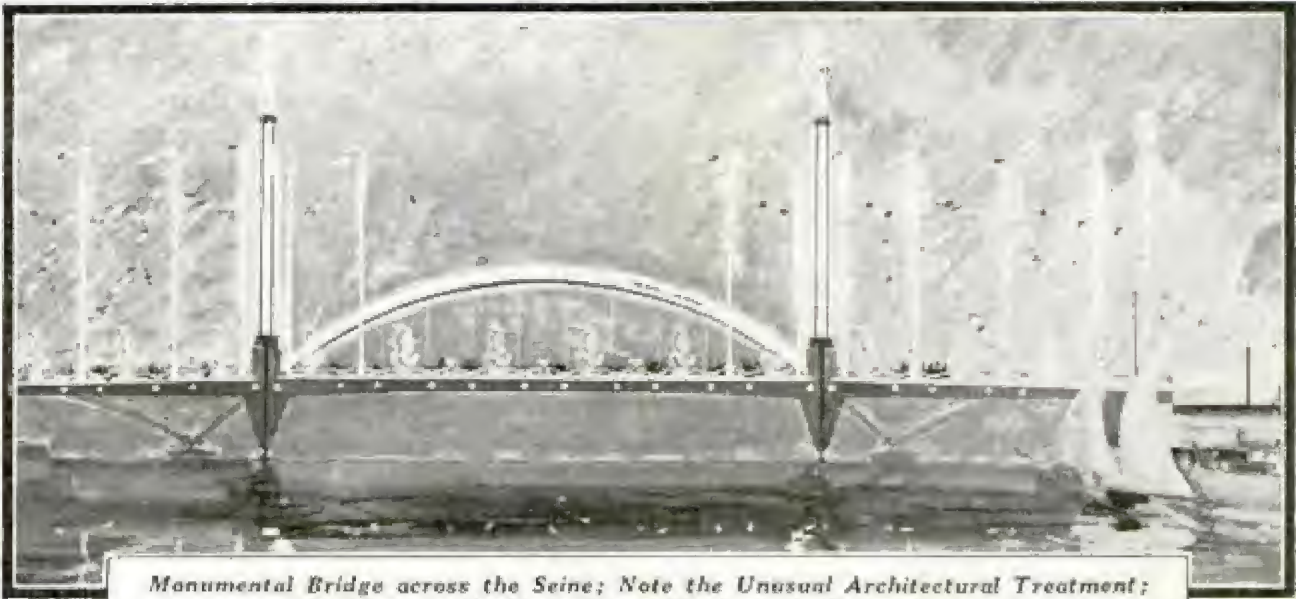


As the Eiffel Tower and Surrounding Buildings Will Appear at Night during the Exposition; the Tower Is a Pivot in the Plans; Visitors May Approach the Grounds by One of Twenty-Two Major Avenues

*I interviewed with Jacques Lerebours
Chief architect of exposition*

4 W. 103 rd. New York

Exposition Will Be Ultra-Modern in Design



Monumental Bridge across the Seine; Note the Unusual Architectural Treatment; Buildings in the Exposition Will Be of the Latest Design



Rocky Corsica, Built in the Seine on Reduced Scale, Will Offer Special Exhibits of Life and Craftsmanship on That Famous Island



Modern Architecture Marks This Bridge across the Seine; a Miniature Seaport Is Being Built on the River for Yachts, Steamships, Cruisers and Tugs; French Water-Front Life Will Be Depicted

Can. James Montgomery 5/7/35
Commissioner Bldg. Toronto 2 And
Canada



Box Compartment in Base of Chair Car; Seat Provides Storage Space for Baggage

LUGGAGE RACK IS ELIMINATED BY SPACE UNDER CAR SEATS

When the porter stows your valise on one Canadian National Railways' chair car, he does not hoist it onto the baggage rack for there isn't any. Instead he places it in a special box compartment which forms the base of the chair you occupy. The elimination of the baggage rack by this storage method saves space in the car and is a convenience for the traveler. The baggage compartment does not interfere with revolving the chair.

8853

SEED GERMINATION IS SLOWED BY RED SPOT IN SPECTRUM

Existence of an unseen spot of red light in the spectrum that has a strong retarding effect on germination of seeds has been discovered by scientists. Ordinarily this power is nullified by the more friendly rays of sunlight that promote growth, but it was observed by breaking up the spec-

Lewis B. Flint, Dept. of Agriculture.
to Smithsonian

trum. Green, blue and violet rays had previously been shown to have an inhibiting effect on seeds while red, orange and yellow light speeded germination. The newly found red spot was located in the red portion of the spectrum near the point where light ceases to be visible to the human eye.

8819

SUN'S RAYS USED TO COOL UNUSUAL REFRIGERATOR

Paradoxical as it may seem, the sun's rays are used for refrigeration in an unusual cooling device constructed by Otto H. Mohr. Ammonia water in a generator tank is heated when the sun shines on a glass sphere, forcing the ammonia through condensing tubes as a vapor, thence into a receiving tank as a liquid. After the sun goes down, the water in the generator cools and absorbs ammonia vapor from the return pipe, resulting in cooling the refrigerating chamber. Different size heater spheres may be used for different size refrigerators.

Concord Calif



Parts of Sun-Ray Refrigerating System; Glass Spheres Help to Focus the Rays

Plastic Statues Supplant Roadside Billboards



Above, Dairy Farm Uses Statues of Mother and Child with Cow to Advertise Its Products along Highway



Statue of Bull, Above, Advertises "Ye Bull Pen Inn"; Long in Use, It Shows Effect of Weathering; Below, at Right, Model of Race Car Advertises Brand of Gasoline; Properly Lacquered, These Statues Withstand Weather for Considerable Periods and Are Seldom Attacked by Vandals; Although Billboards Sometimes Cause Protests against Disfiguring Landscape, the Motoring Public Does Not Seem to Object to Roadside Sculpture; Statues Are Cast from Molds and Are Relatively Inexpensive to Manufacture



Plastic Sculpture Is Becoming Popular with Highway Advertisers in the West; Statues Dramatizing the Product Are Molded, Set on a Firm Base, Then Lacquered to Resist Weathering; Above, Statue of Knight on Horse Advertises Hollywood Pharmacist; Left, Plastic Bell Boy Attracts Motorists to Hotel



8569.

Cmd. James McQuerry, 2222
Sherman Ave. Evanston, Ill.

EASY DOG STUNTS



Teaching a Dog the "Grapevine"; Above, Right, Coming at Call, the First Step in Training



Using a Cane to Train a Front-Leg Walker, and a Good Dog Saying His Prayers

THERE is no dark mystery surrounding dog training. On the contrary, it is a simple process with patience and common sense as its two most important elements, say those who train performing dogs for the circus.

Not every dog can be taught tricks, however. Some are clever, others are dullards. Also, some have a natural aptitude for doing stunts and grasp ideas quickly, while others, equally intelligent in other ways, lack the inclination or ability to master even the simplest tricks. There is a myth that the alley-bred dog is superior to the blueblood in doing amusing feats. A well-bred dog, according to the circus trainers, is just as smart as a mongrel, if not more so, and a lot better looking.

Do not try to train your dog until he is seven or eight months old, say the circus trainers. A puppy usually is a poor stu-



Training the Dog to Sit Up Is the First Step in Teaching the "Salute the Flag" Trick; Left, First Step in Teaching Dog to Walk on Hind Legs and First and Second Stages of Action as Dog "Plays Dead"

dent. His physical development is inadequate and he hates to put his mind to anything. Three-fourths of the training problem is solved when a dog learns the simple command, "Come here."

"Having your dog 'under your finger'," explains Dennie Curtiss, a trainer, "is a virtual necessity in all tricks. When you call and he comes, no matter what he is doing, you can launch your formal training program with the assurance your efforts are not going to be in vain."

Some trainers employ a long clothesline in teaching this cardinal point. If the pupil does not understand you are calling him, a short tug on the rope conveys the message. Or, if the dog does not choose to hear, the rope tends to discipline him and he soon learns obedience. Then the rope may be discarded.

A dog likes to be amused and the amateur should capitalize on this point just as the professional trainer does. Make the practice periods zestful, not more than fif-



Above, Shoulder Harness for Teaching Somersault; Right, Using a Bicycle Tire to Teach Jumping Trick; Below, This Fox Terrier Is Just a Natural-Born Performer

trick. This trainer says it makes sea lions out of dogs and lessens their efficiency. And, of course, a bait-broke dog won't play if his trainer hasn't a supply of tid-bits.

His method of teaching a dog to sit up is a logical starting point for training. He places the dog in a corner so he is braced by the two walls. The weight should be distributed evenly so the animal can sit straight in an easy, relaxed manner. Hold him up by his paws for a minute or so, then allow him to rest. The dog soon will sense what is expected of him and when he becomes accustomed to this posture, he



teen or twenty minutes at a stretch. Study the dog you are instructing. By his actions you should be able to decide what stunts are best suited to his capabilities. Concentrate on these and the success thus engendered will spur him to more difficult feats.

The dog's intelligence can be sharpened by talking to him in a kindly, human way. When presenting a trick, it should be clearly defined and its movements condensed. The training methods should never be changed when once started as this is apt to confuse him to such an extent that the whole idea may have to be abandoned.

Verbal encouragement should be used generously, but Roy Lewellen advises against rewarding a dog with morsels of food or sweetmeats at the conclusion of a



can be moved away from his artificial supports.

Once this is mastered, it is easy to teach him to "shake hands," "hold the baby" and "salute the flag." The "handshake" should be taught first as a movement cue, and later as a verbal command. The first he should master as soon as he realizes you are not trying to throw him off balance, but the latter will take more time.

Much patience is needed to train him to hold a rag doll between his front paws. When he drops it the first few times, pick it up and replace it between his paws. If he tries to run away with the doll in his mouth, he

(Continued to page 126A)

lens green. The streamline, chrome lamp contains a single flashlight battery.

D Little Boston Mass.

Simple to operate and less costly than similar instruments, a small exposure meter is available for the amateur and professional photographer. It has no lens, needs no focusing, is effective in and out of doors and can be used with plates or film of any make. The intensity of the light is determined through a narrow opening in the meter, then the guide number is selected and the camera set accordingly.



PAINTERS' SCAFFOLD IS RAISED ON TELESCOPING PIPE



Here Is the Latest Thing for Supporting Painters' Platform; It Works Pneumatically

In place of the usual painters' ladder or the scaffold that dangles precariously from the eaves, a Kansas City, Mo., painter devised a platform that is raised pneumatically on a telescoping pipe. Small rubber-tired wheels roll up and down the side of the house as the platform is raised or low-

ered, and it is similarly moved from side to side on a wheeled carriage adjustable for uneven ground. Workmen can sand-blast, stucco, paint and spray in safety and comfort on the portable platform.

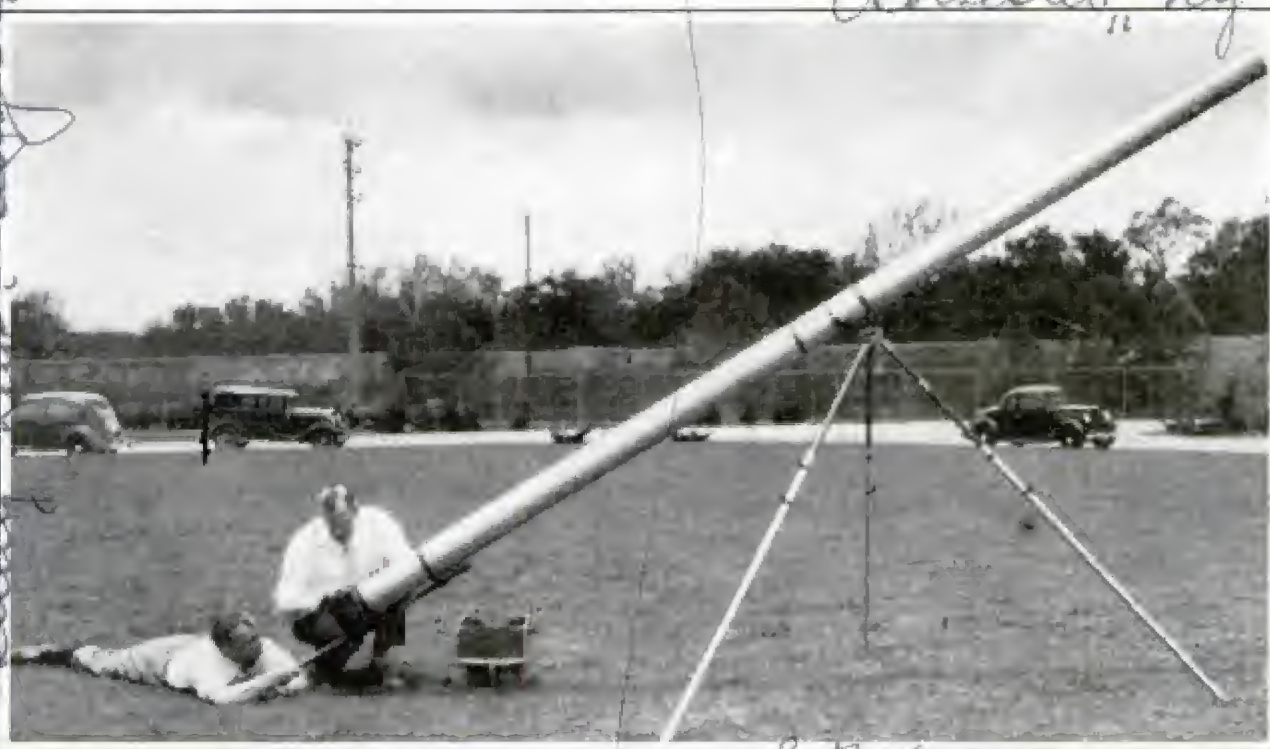
ELECTRIC HEAT GUN IS HANDY IN GARAGE OR HOME

For thawing frozen grease in the automobile, drying spark plugs and ignition wires, removing ice from windshields and thawing frozen water pipes in the home, a small electric heat gun has been developed. It provides a maximum temperature of 400 degrees Fahrenheit and is equipped with a fan that directs the heat in the direction desired. The gun plugs in on the lighting circuit, alternating or direct current. It weighs six and one-fourth pounds. Attachments include a wide flare nozzle for radiators and large surfaces, a short gooseneck nozzle for transmissions, a long gooseneck for differentials and a long, flexible hose for inaccessible places. There also is a chain and hook for suspending the gun under the car or elsewhere. The mechanism is completely protected from dirt and grease by the housing, which does not get hot because the heating element is sheathed with asbestos.



Drying Out Distributor with Heat Gun That Blows Warm Air through Wide Nozzle

Tubular Camera Spots Aircraft Miles Away

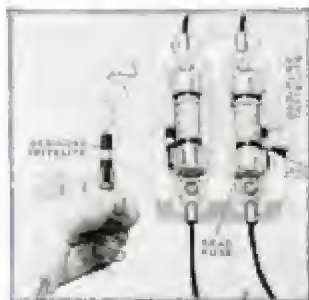


Lens and Photograph Plate Are Fifteen Feet Apart in Tube Which Replaces Bellows

Balloons in the stratosphere and planes speeding at 20,000 feet above the earth can be photographed with a long-range camera developed by the army air corps. It resembles a field telescope, with its eighteen-foot tube resting on a tripod. Lens and plate are fifteen feet apart in the aluminum tube, which replaces the conventional bellows. The camera can spot a balloon fifteen miles away. A stratosphere balloon made a half-inch image on one negative, and the moon appeared on another about the size of a silver dollar.

BLOWN FUSE IS LOCATED BY TINY NEON LIGHT

To locate a blown fuse instantly in a bank of fuses there is a tiny neon light bulb connected in parallel with the fuse by means of insulated pigtail leads. When the fuse goes out, the current is diverted through the neon lamp, so sensitive that it lights on a fraction of one milliamperere.



OUTDOOR LIBRARY LENDS BOOKS TO MADRID PARK VISITORS

Open-air bookshelves stand in a Madrid park, furnishing good reading to visitors resting in the shade. The library is on the "honor system." Books are entrusted to the people's care, and none is ever stolen.



Good Books Are Always Handy on Open Shelves Near Park Benches in Spanish Capital

Littlefuse Laboratories

450 N. Dearborn

Chicago

9. 6. 81

HEROES of the

*Cmdr. John L. Coontz
Route 4 Anacostia D.C.*



FOUR army flyers are proceeding in formation above Crissy Field, Calif., when suddenly flame and smoke burst from the head of one of the ships. The engine has disintegrated and the plane is on fire!

In that moment when life depends upon action Second Lieut. Frederick Anderson acts. He signals to his companion to "bail out" and himself prepares to follow. Mechanic MacVean needs no second warning. He crawls from the flame-encircled cockpit and swings into space. Anderson slips a leg over the side. Then he notices San Francisco lies below him. To let that flaming meteor of steel and canvas drop into the city is to invite wholesale destruction.

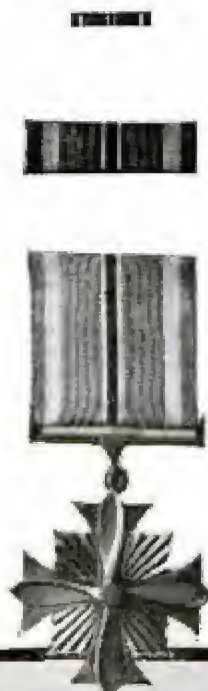
With fire around him



Parachute Jumper Just after Leaving Plane, and Balloon Basket in Which Capt. Hawthorne Gray Perished on Altitude Flight; the Distinguished Flying Cross Was Awarded Him Posthumously

Handwritten notes at the bottom of the page, including "Distinguished Flying Cross" and other illegible text.

FLYING CROSS



What Happens When Flyer Takes to Parachute from Burning Plane, a Giant Flare Simulating the Flaming Ship in This Case; Upper Left, Distinguished Flying Cross



Stratosphere Balloon and Gondola in Which Kepner, Stevens and Anderson Ascended

and the danger of explosion hovering over him, Lieut. Anderson crawls back into the cockpit. He fights frantically for the controls. At last he succeeds. He pulls the plane out of its spin and heads it for the near-by bay. He is saved from drowning by a sailor who leaps into the water with a knife between his teeth and cuts away the cords of his parachute which, caught by the wind, is dragging him to a watery grave, head foremost.

Such exploits as this lie behind the award of the Distinguished Flying Cross to Uncle Sam's flyers. All these feats of heroism are not, however, confined to planes. There is, for instance, the story of Robert Bottriell, master sergeant of the air corps. Bottriell tests parachutes. He has been jumping out of the sky for more than twenty years.

"One of these jumps," he says, "I shall never forget. It was at McCook Field and I was attempting to beat the existing parachute jump of 18,000 feet. At 19,500 feet, I told the pilot I was going to jump. He turned his rudder slightly and nosed his plane into the air. In the meantime I threw off moccasins and coat and signaled I was leaving when part of my parachute har-



Left, Major Kepner and Captain Stevens Planning Their Stratosphere Flight; Below, a Group of Army Balloons Lined Up for a Race; Many Balloonists Have Been the Recipient of the Distinguished Flying Cross



ness must have caught on the gun turret, pulling the rip cord of my pack and ripping the parachute. The parachute was thus released, the wind caught it and I was jerked from the cockpit and whipped through the rudder of the ship. My impact with the rudder caused it to give way entirely and break my guy cords. If the rudder had not given way my arm would have been torn off. The force of the arm blow rendered me unconscious and I dropped about 5,000 feet before I regained my senses.

"I looked for the plane but could not see it. Then I noticed one panel of the 'chute had been ripped its entire length by the rudder. When I tried to raise my left hand I was unable to move it or work my fin-

gers. I thought I had merely broken it until I found blood was streaming from my hand and my sleeve was saturated with it. With my right hand I pulled my left one around in front and saw the flow of blood was strong. If it continued until I landed I would probably bleed to death. Lifting my arm high, I fastened the hand in the webbing of the 'chute.

"Three times my hand worked out of the webbing and dropped down, but each time I was able to fasten it above my head again. At last I noted I was within 500 feet of the ground. With the wind rushing through the torn panel of the 'chute, I knew my landing would be harder than usual, so I pulled the jerk cord of my

(Continued to page 120A)

Store on Rails Helps Small-Town Merchants



Salesman Is Taking Orders from Local Merchant as Traveling Wholesale Store Pauses at Railway Station in Small City; This Car Is Display Room for Handbags and Cosmetics

Latest evolution of the traveling salesman is a wholesale house on wheels, an eleven-car railway train now touring the country to display merchandise to buyers in their own cities. Built for Marshall Field and company by the Baltimore and Ohio railroad, it is a complete store and hotel, including baggage and dynamo car to furnish light, lounge car, dining car, two sleeping cars for crew and representatives of the Chicago wholesale house, and six coaches equipped as modern showrooms. When the train pulls into a station telephone lines are plugged in and local buyers invited to call; a teletype in the "office" is also connected with commercial telegraph lines and messages and orders are transmitted between the store on wheels and its home office.

Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information is kept on file and will be furnished by our Bureau of Information upon request, accompanied by stamped, self-addressed envelope.

FOUR-LETTER CODE LOCKS CAR SOUNDING HORN AT THIEF

Take a four-letter word, set your combination with it, and anyone who tampers with the ignition of your car will start the horn blowing a continuous alarm.

This combination lock for automobile ignition is being manufactured in England. Small knobs on arms of different lengths rotate separately around the lettered dial. To unlock the car when the code is set to the word "WIND," turn the shortest arm to "W," the next longer one to "I" and so on. An additional protection against thieves is a connection that sounds the horn when hood, doors or the car itself is moved in the owner's absence. This warning connection is cut in by pressing a secret button on the outside of the car.



Coleman and L...
19. Rathbone

Place Oxford St. London. W.1. England.

Chas. Hansen Products Ltd., 280 Leaning Gate St.

Radio-Guided Model Plane

818 Races Fifty Miles an Hour



acm.
Fifty-Mile-an-Hour Gasoline-Powered Model Plane with Seven-Foot Wing Spread Is Controlled from Ground by Radio

1090 4 Shale Cleveland Ohio
With a wing spread of eighty-four inches, a flying model airplane has been equipped with radio control so that it can be operated from the ground. This trimly designed monoplane is powered with a miniature gasoline motor. The ship is capable of a top speed of fifty miles an hour and is equipped with landing gear.

VEST-POCKET ELECTRIC TESTER ALSO USED AS SCREWDRIVER

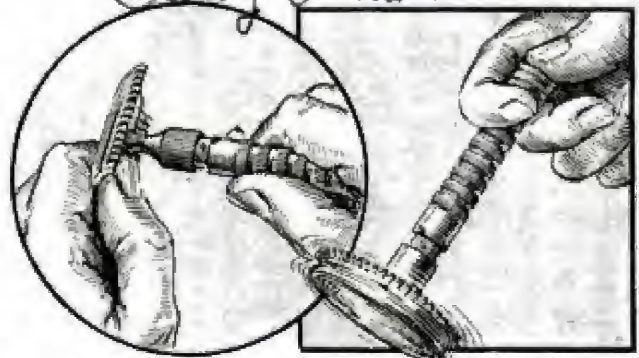
Carried in the vest pocket like a fountain pen, a tiny electrical tester made of ebonite is so designed that it is shockproof. It may be used on 100 to 600 volt circuits, alternating or direct current, and is handy for locating blown fuses, testing radio transformers, spark plugs, armatures, batteries,



neon signs and condensers. It is efficient for indicating open circuits, leakages, types of current, improper earthing of conduit cables, insulation, neutral wires, potential, continuity and polarity. It can also function as a magnetic detector for checking field connections on small motors, the polarity of permanent magnets and in determining ferrous from non-ferrous metals. Used with a search wire it is convenient for many bench tests. It can be used as a screwdriver for light work and has a compass in the removable cap.

SELF-RINSING RAZOR REMOVES WATER BY SPINNING

6790
Operated by the touch of a button, a handle that fits any Gillette type of safety razor will dry and clean itself within a few seconds, thus protecting bathroom towels and the fingers of shavers from cuts. The handle is attached in place of the regular handle. Just before shaving it is screwed to the



Special Handle Attached to Razor Spins Head Like Top and Dries Blade Instantly

right, much as an automatic top is wound up. When the shave is completed the razor is rinsed off with water. Then the button is pressed. This releases a spring inside the handle, causing the razor head to spin at such speed that the water is thrown off and the razor and blade dried quickly.

*C.D. Stair Mfg Co
330 S. Wells*

180
 4 W. 10 3 rd St
 New York

SEADROMES!

Says Bleriot



Sketch of Landing Surface of Floating Seadrome; the Double-Hulled Ship Represents a Scale Drawing of the "Avion-Marin" Which Louis Bleriot Has Designed

FLYING alone in a twenty-five horsepower "crate," a daring Frenchman crossed the English Channel between Calais and Dover on July 25, 1909, thus giving ocean flying its humble beginnings only six years after the Wright brothers made their first power flight at Kitty Hawk.

Today, Louis Bleriot, the father of ocean flying, is still keenly alive to the problems of marine air transport. He is one of the foremost builders of ocean transports and his flying boat, the "Santos-Dumont," has established a record of fifteen crossings of the south Atlantic. Bleriot's factory is producing both military and civil aircraft.

In a recent interview in his Paris home, M. Bleriot revealed that he is actively interested in an ambitious plan to make transatlantic flying commercially profitable. He and his research staff have carried out numerous experiments toward producing a new type of ocean transport such as has never been seen before.

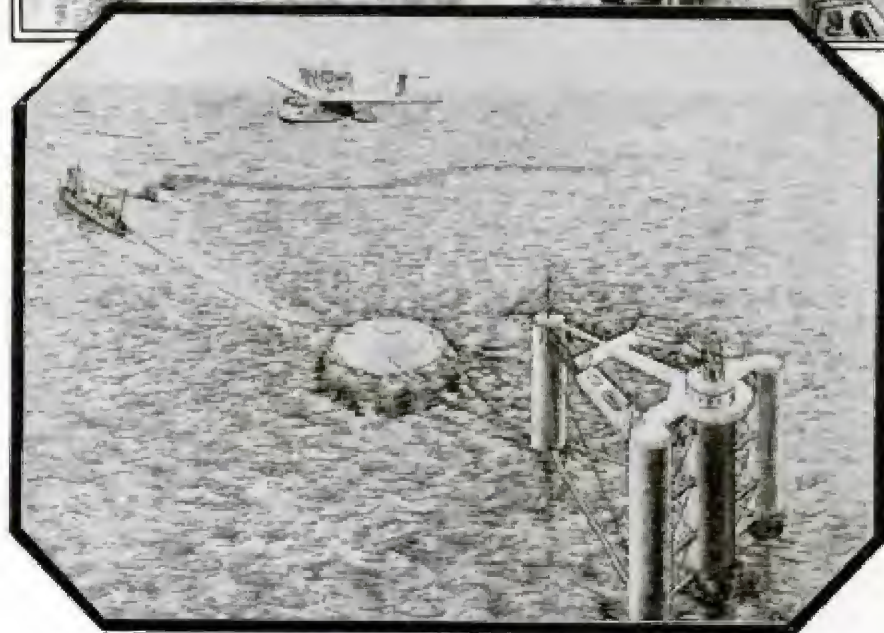
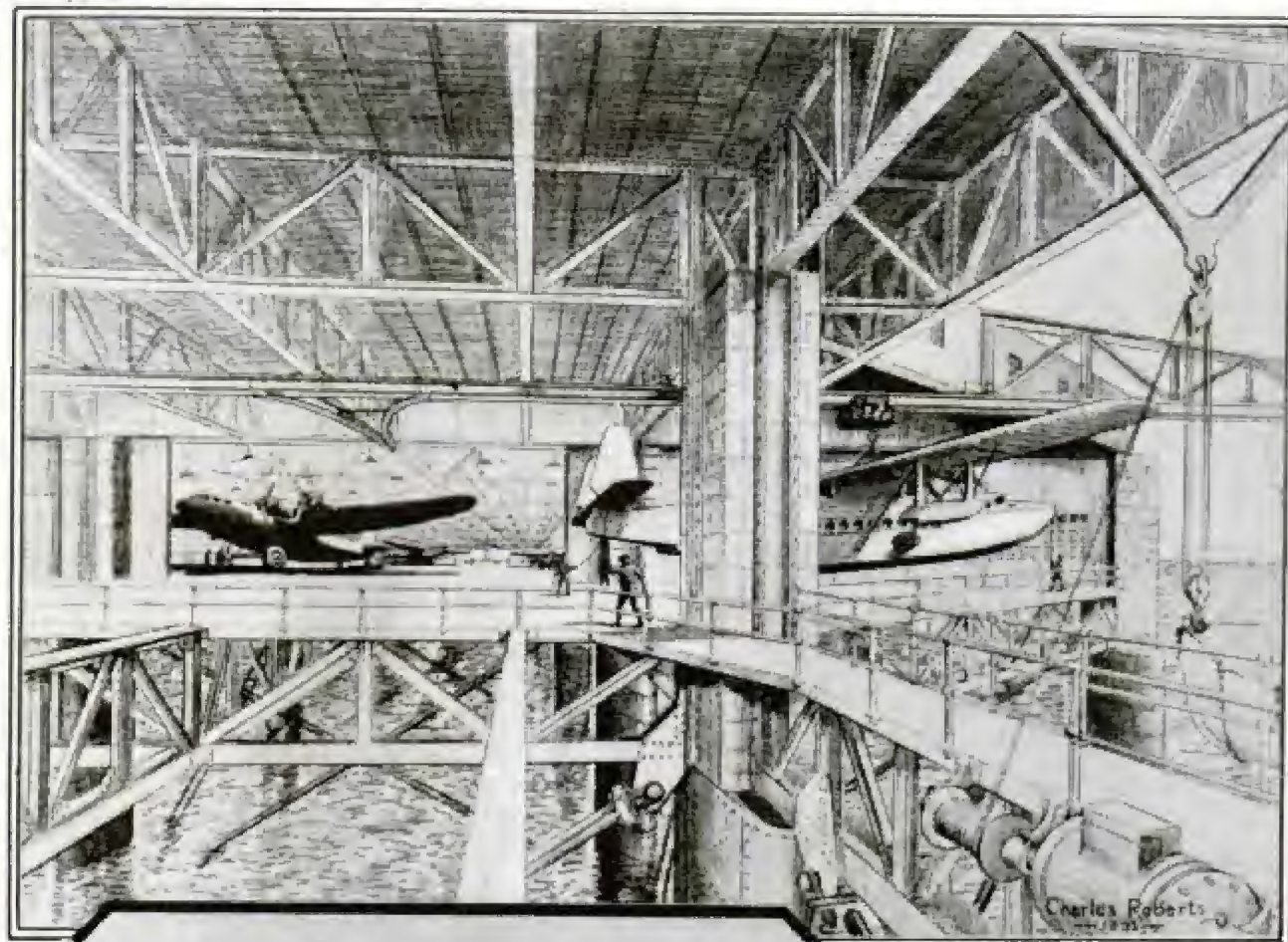
Working closely with the French government, M. Bleriot has completed designs for an aircraft which he calls an "avion marin." This "marine airplane" is not a flying boat, a seaplane, or a hydroplane. It consists, first of all, of a huge wing, about

100 feet from tip to tip, which sustains two whale-like passenger and freight-carrying compartments. The motors are in the rear of the wing and the entire aircraft weighs about fifteen tons.

M. Bleriot says an undercarriage is unnecessarily wasteful because it retards speed and adds considerable weight. His "avion marin" is essentially a land plane, but it is also adapted to landing on the ocean if necessary.

"Ocean flying on a commercial basis," he said, "can never advance very far unless some means is found of increasing the present proportion of pay load to the weight of fuel carried. If a marine transport can fly the Atlantic in a single hop, it means that about half of the total weight carried is fuel, and only five per cent consists of pay load. Therefore you are carrying ten times as much fuel as pay load! Compare this with the record of the 'Normandie,' the fastest form of merchant-ship transport. The 'Normandie,' carrying not more than seven per cent of her total weight in fuel, can cross the north Atlantic in about 100 hours.

"I have concluded that a non-stop commercial flying boat service across the



Above, Interior of Floating Seadrome; Below, Towing Anchor and Anchorage Buoy for Armstrong Seadrome to Sea

north Atlantic cannot be made to pay for itself. The costly ratio between fuel and pay load explains why. Air-mail letters by themselves will not pay the cost of flying the ocean. Transport companies must rely on passengers and freight as the chief sources of revenue.

"The only way I can see of making an ocean flying venture profitable is to have intermediate stops all the way across. For

that reason I have developed a new type of ocean transport with a greater safety factor than any previous type, which will also carry an appreciable pay load. The successful use of my 'marin avion' for flying the north Atlantic will depend, of course, upon the use of floating islands, of the seadrome type developed by the American inventor, Armstrong. It is commonly assumed that the idea of floating airports in mid-ocean has been

discarded. On the contrary, they have never been more necessary for transatlantic air service. Armstrong and I have co-operated and the seadrome has reached a stage of development which will make it highly useful to ocean transport lines.

"Now, suppose that we had but one seadrome in the north Atlantic. It would mean that for every pound carried as freight we would need only two pounds

for fuel, as opposed to five pounds of fuel for every pound of freight with the non-stop air transport. After long years of study I have submitted to the air minister of France my plans for my 'avion marin,' a monoplane capable of carrying twenty passengers at a commercial speed of about 170 miles per hour.

"People often confuse the real reason for having seadromes. A non-stop flight across the Atlantic is not an impossible feat. Seadromes are not designed to make regular transatlantic flights possible, but to make them payable. There is a definite limit to the volume of air-mail traffic which we may expect between America and Europe. Fast steamships and competition between air lines will make the dream of a huge air-mail traffic appear fantastic. We must depend on freight which is heavier and less remunerative.

"The use of Diesel motors on heavier-than-air ocean transports will not affect the situation very much. The cares of placing commercial transport on a paying basis are not the only ones we must consider. Safety is another factor. The north Atlantic is a 3,000-mile stretch of water, without a haven for an aircraft in danger. Even in the greater safety of air transport over land, we have established beacons and emergency landing ports. If you carry passengers, the presence of seadromes along the north Atlantic route would certainly give you a feeling of 'moral security.'"

M. Bleriot also has designed an "accelerometer," an oval-shaped race course, for studying the aerodynamic qualities of planes operating under high speeds.

He is an exponent of the plan of placing motors in the rear, instead of in the front, of airplane wings. Rear engines give five per cent more power, he claims, and reduce the fire hazard. Passengers enjoy increased comfort because rear engines are less noisy and in an emergency, it is easier to jump clear of propellers mounted in the rear of an airplane.

M. Bleriot does not regard his historic flight across the English Channel as a great adventure.

"It was merely," he said, "an event in the history of aviation. The results, however, have been important. It was the forerunner of many wonderful ocean flights to come."

PHANTOM ALARM TELLS WHEN INTRUDER APPROACHES



Alarm Detects Intruder's Approach and Warns Family by Ringing Bell and Lighting Lamp

Detecting the presence of an intruder and giving the alarm before he even touches the bedroom window is the task performed by an electrical relay known as the Faratron cell. Plugged into a wall socket, the cell looks like a small radio with a tube and doorbell on top. Two wires lead from its base, one to the dresser light, the other to the window screen. When a burglar reaches for the window, the dresser lamp lights up and the bell rings. The Faratron cell operates without light beams or other visible controls. Merely the nearness of a body or object sets the circuit in operation. The cell is a development of the relay control of electric currents by means of phantom circuits. It is an adaptation of radio oscillation and can be built and operated by anyone familiar with these types of circuits. Protection is but one of its possible uses. It will automatically open and close doors, turn lights on and off, illuminate display windows as pedestrians pass by and start or stop machinery.

Our Bureau of Information will answer questions regarding articles in this magazine, if accompanied by return postage.

Luminate Electric Co. 37 W. Van Buren Chicago
H. H. H. Products Co. 20 N. Orleans Chicago

Jan 17 36-1320

IT TAKES NERVE TO "DOCTOR" LOFTY FLAGPOLES



High above the Roofs, This Daring Specialist Keeps Flagpoles in Condition

Louis Charters is a "doctor" of flagpoles. Two hundred tall shafts are on his list. It is his job to paint them, to keep them in repair; see that ropes are replaced and pulleys oiled. When an old pole is in danger of falling, he must replace it. "Sure, the wind blows and sways the pole crazily, sometimes," says Louis, "but it's all a part of the job. Sometimes the old wooden ones are not as strong, and I have to tap them as I pull myself up to make sure they're safe. That wouldn't always show up defects in the wood, but it's the only thing I can do. Break? Oh, yes, it can happen!" How does he get to the top of his poles? He has fitted up a rigging device, consisting of a wooden seat attached to the pole with inch ropes. Another rope loop encircles the pole and his shoulder. A pair of rope stirrups hangs from the seat. By hoisting the top loop an

arm's length, bending his knees and pulling the lower loop up an equal distance, he ascends the pole. Charters tells of one narrow escape: "The pole was old and the rope had fouled near the pulley. Tapping the pole carefully as I worked up, I could detect nothing wrong. As I started cleaning the pulley, the wind suddenly howled across the roof tops and the top of that pole broke off beneath my hand. My legs clinched the lower part and I reached to catch the heavy brass ball that was splintering loose. That almost sent me down, but I got it and held on, while the pole vibrated back and forth. It took me a few seconds to regain my balance and then I slid down to the roof."

AUTO PAINT IS DRIED QUICKLY BY PORTABLE BAKER

Ten to eighteen minutes of baking with a portable heat-reflecting unit are sufficient to dry paint on an automobile. An electric baker is now being made on a heavy cast-iron tripod base which prevents tipping over. It wheels easily on ball bearings. For refinishing paint jobs, the primer coat is baked ten to fifteen minutes and the surfacer coat fifteen minutes. When two surfacer coats are applied the first is baked twelve minutes and the second eighteen. This heat unit can also be used to warm small rooms, thaw frozen radiators, brakes and carburetors and help start the car in zero weather.

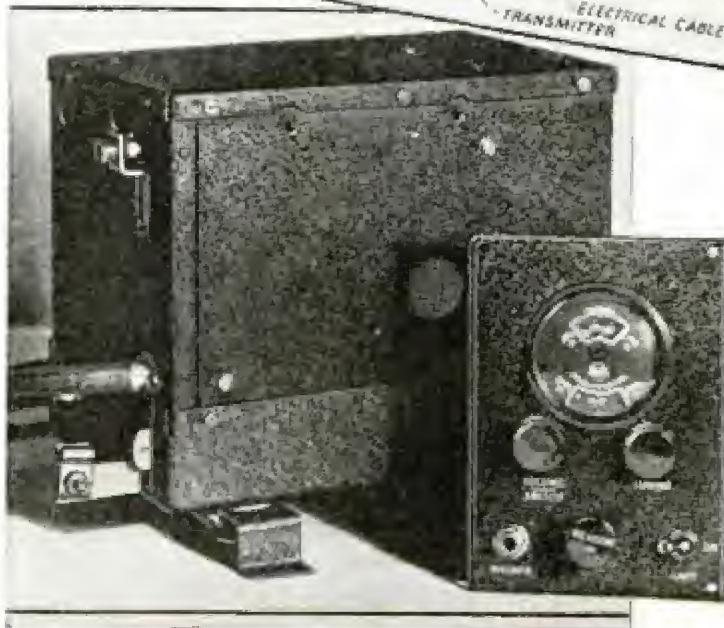
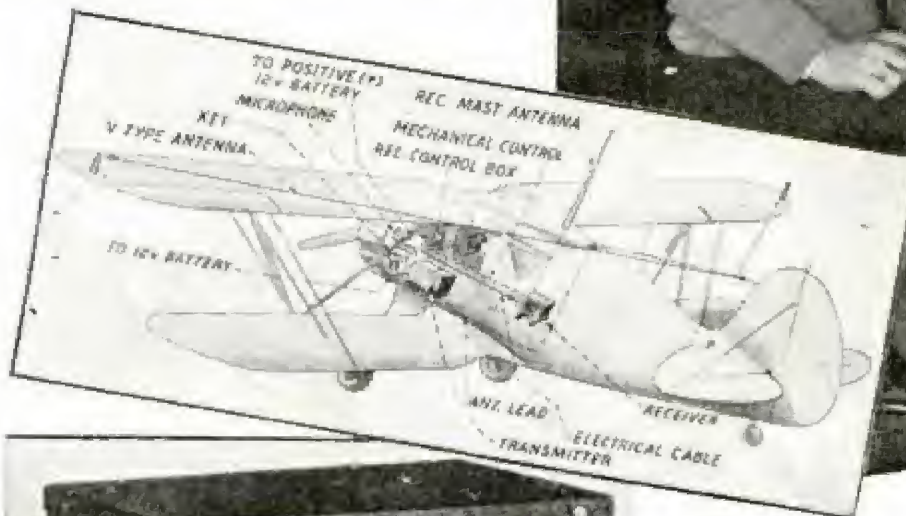


Electric Heating Coils in Portable Reflector Speed Up Job of Painting Car

Opal Electric - N.Y.C.
1935 Martindale

Compact Two-Way Radio Fits Small Plane

Compact and lightweight radio receiving and transmitting outfits for airplanes are now on the market, the dials for the receiving set occupying a small space on the instrument board and connected by remote control with the receiving apparatus at the rear of the ship. The superheterodyne receiver has four multifunction tubes yielding the equivalent of six-tube performance with an



Above, Pilot Slides Chassis of Radio Telephone-Telegraph Transmitter Out of Housing for Inspection; Left, Receiving Apparatus and Compact Receiving Control Box for Instrument Board; Diagram Shows How Two-Way Radio Equipment Is Installed in Small Plane

economy of power. It operates on dry cells or storage batteries and weighs sixteen pounds, ten ounces. There are two models, one receiving beacon and entertainment wave bands and the other beacon and communication bands. The twenty-watt transmitter weighs thirty-eight pounds and is housed in a single case ten by ten and one-half by sixteen and three-

eighths inches. It gives the pilot three methods of transmission—telephone, continuous-wave telegraph, or tone-modulated continuous-wave telegraph. Reception is in the frequency range from 2,000 to 6,500 kilocycles. A twelve-volt storage battery or other direct-current source supplies power. The entire chassis of the transmitter slides out of its housing for inspection. It is designed to assure efficient communication with the ground under any conditions.

(Names and addresses of manufacturers and dealers in articles described in this magazine will be furnished by our Bureau of Information upon receipt of a stamped, self-addressed envelope.

New CONVENIENCES



Left, Latest in Floor Lamps, with a Six-Way Switch That Controls Light Intensity; an Outer Flange on Switch Lights Bulbs in One, Two, Three Succession and an Inner Flange Provides Intensities of 100, 200, and 300 Watts in Reflector; Right, Combination Cooker That Has Adjustable Strainer Openings in the Cover to Permit Pouring Off Excess Water without Removing the Cover; a Complete Meal Can Be Cooked at One Time over Single Low Flame; Cooker Has a Two-Quart Inset Pan That Adapts It to Uses of Double Boiler



Right, Above, Sulky Large Enough for Twins Folds into Small Space for Car



Left, Folding Mail Box Opens to Hold Parcels, Magazines and Newspapers; Right, Compact Kitchen Contains Ovenette, Electric Refrigerator, and Sink; Cabinet Is Five Feet Long and Made of Furniture Steel



for Your HOME

Left, Below, Crystal Garden Has Terra-Cotta Shells to Hold Greenery, Covered by Glass Sphere; Moisture on Inside of Globe Shows Need of Water That Is Introduced through Cap; Right, Reversible Card Table with One Side for Poker, the Other Suitable for Bridge or Dining



Left, Below, Round Electric Stove Permits Cooking from Any Angle; It Has Casters for Easy Moving around the Kitchen; Right, Simple Water Purifier Attaches to Faucet in Fifteen Minutes and Can Be Removed Quickly; It Operates for Months without Attention; Recharging Is Easy



Fort on Wheels Carries Government Money



Top, Latest Armored Money Truck; Bottom, Interior Showing Guards and Weapons

Armored with a new bulletproof steel, the latest vehicle for transporting money literally is a fort on wheels. Every portion of the car, recently delivered to the Federal Reserve bank of Chicago, is guarded by the steel, which was developed to resist bullets that have practically doubled in speed and penetration in the last two or three years. From the sides of the stream-

line car can be expelled clouds of tear gas capable of stopping bandits for a safe distance around the car. On the inside is a bulletproof compartment where the control man of the crew sits. All doors are electrically controlled and cannot be opened without his release. When doors are open, he still controls the front, back and sides of the car with tear gas and gun fire. In case of trouble while the car is moving, the control man can set the brakes and cut off the ignition. Special equipment supplies conditioned air. A powerful motor gives the car a quick pickup and unusually high speed. Ten men can be carried. The car is equipped with machine guns, rifles, pistols, gas bombs and gas masks.

Exercise Bike Combines Motions of Rowing and Pedaling

Combining the motions of rowing and pedaling, an exercise machine resembling a bicycle has been invented. It is designed for four persons, two on the front seats pedaling and guiding and the two on the rear seats helping to propel by "rowing." The vehicle looks like two tandem bicycles with interlocking framework. Another exercise machine for two persons resembles the tandem bicycle, but has the rowing apparatus installed for the rider at the rear. Called the "Sportmobile," the machine is said to be capable of thirty miles per hour.



Machine Designed for Whole Family's Exercise Is Propelled by Four Persons, Two Pedaling and Two "Rowing"

I.W. Clement Sabaeff
 1471 McMill College Apt. 3

Radio



Short-Wave **SUPER** has Crystal Filter

WHILE of comparatively recent adoption, the use of a Piezo-electric quartz-crystal filter connected in the i.f. amplifier is now standard practice in high-grade receivers for amateurs and short-wave listeners. The filter may be switched in or out of the circuit as desired and provides single-signal selectivity for good c.w. and phone reception in badly congested bands.

The short-wave listener, ambitious for an impressive DX log and a record-breaking collection of verification cards, will find this system very effective. A practical application of the crystal filter is employed in the 7-tube super-heterodyne receiver illustrated. The set is completely self-contained and the crystal used is a standard type in a plug-in holder which fits into an ordinary wafer-type tube socket, as shown in the lower photo.

Two controls for the filter are located at the extreme left on the front panel as will be noted in the upper photo. The lower knob is the switch which connects the filter in series with the i.f. amplifier unit, the



upper control is for a variable condenser, connected across the secondary coils, which tunes the circuit at resonance. This condenser is in one side of a balanced bridge circuit and permits the crystal control to be shifted a few hundred cycles back

(Continued to page 138A)

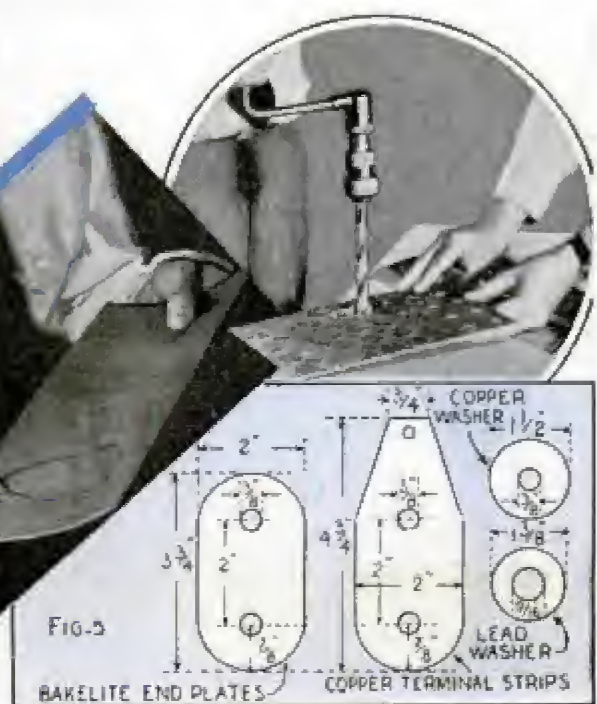
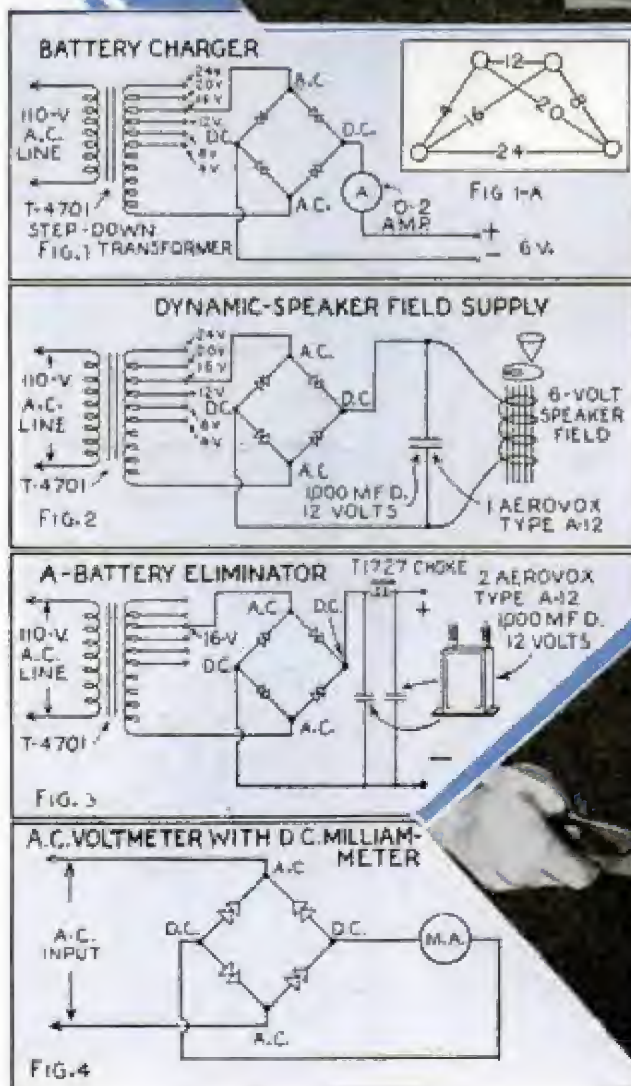
The Hallicrafters club
3001 Southport Ave Chicago

How to make Copper-

By ARTHUR KENNEDY

COPPER-OXIDE rectifiers are quite simple and are commonly used to change a.c. current to d.c. for operating battery chargers, A-battery eliminators and field supplies for dynamic speakers; they also have other useful radio applications. Very little practical construction data have been available for experimenters, and the purpose of this article is to describe a simple copper-oxide dry-contact rectifier that anyone can build without oxygen, an electric furnace, or any tools more complicated than those found in the average home workshop.

Dry-contact rectifiers are of various types; however, all of them include a common junction between two dissimilar substances. This copper-oxide variety consists of copper disks, with a coating of oxide on one side, and lead washers to insure uniform pressure over the entire surface of the copper oxide. In this unit the rectifying action takes place in the copper disk between the disk surface and the copper oxide formed



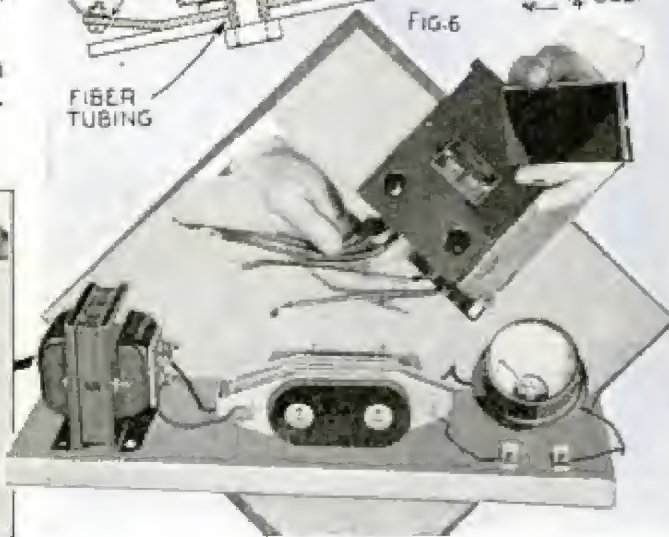
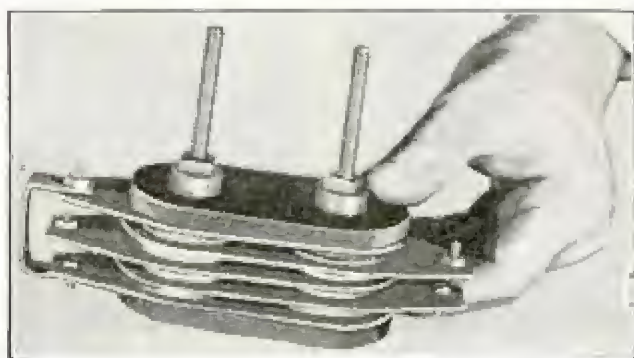
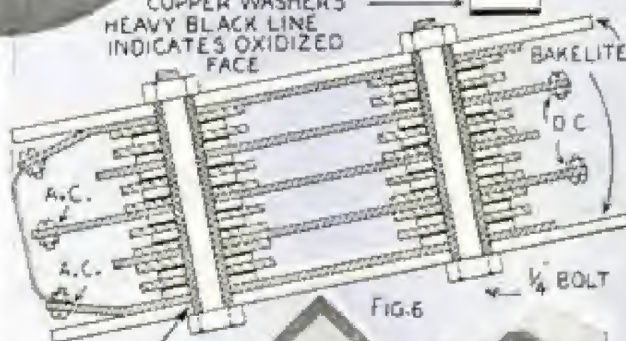
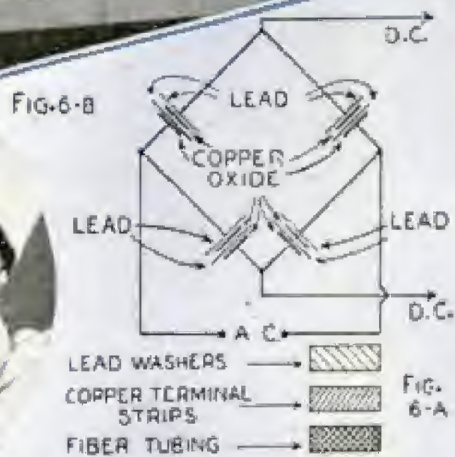
Oxide Rectifiers

on it by the heating process to be described. Each rectifying element offers a high resistance to the flow of current in one direction and permits it to flow freely in the other. Thus, when alternating voltage is applied to the a.c. terminals of the unit current flows through it in only one direction, in the form of pulsating direct current. The input a.c. voltage should be two or three times the desired d.c. output because of the voltage drop in the rectifier.

The unit illustrated in the photos and diagram, Fig. 6, supplies rectified d.c. current at 6 volts. This is the type of unit employed for the purposes previously mentioned, and the hook-ups are given in Figs. 1, 2, 3 and 4. A Thordarson tapped-type T-4701 stepdown transformer, or a smaller transformer that will supply the necessary 16 to 18 volts a.c. may be used for the input. The secondary leads of T-4701 are so arranged that they may be connected to supply a number of different voltages as indicated in Fig. 1-A.

The copper and lead disks are made in the form of washers; 16 of each are re-

(Continued to page 140A)



How to Install a Good Receiving Antenna



FIG. 9

By F. L. BRITTIN
PART III

TWO, or three, 10-ft. lengths of ordinary copper drain pipe can be soldered together to make an effective non-directional antenna of the vertical type shown in Fig. 9. Erected on a flat roof where it may be guyed properly, it has equal receiving ability in all horizontal directions from its vertical axis. This is an excellent antenna for the all-wave listener in locations free from man-made static interference.

A heavy box or wood block is used to support the pipe several inches above the roof. It should rest directly on a porcelain insulator; if a suitable insulator is not available, use a heavy glass plate or an inverted porcelain bowl. Each guy wire should be broken in at least three places with 3-in. glass or porcelain strain insulators. Beginning 1 ft. from the pipe, space the remaining insulators about 3 ft. apart.

The copper pipe now acts as an insulated signal collector. The lead-in wire should be soldered securely to the bottom of the pipe and brought down to the set on

stand-off insulators, as directly as possible.

A filtered variety of the inverted L antenna is shown in Fig. 10; this system is designed for use in noisy locations. Although it employs a transmission line, the antenna coupler is mounted on the flat-top supporting wire nearest the house end of the antenna instead of at the center of the flat-top as in the doublet systems previously described. Available in kit form, this filtered all-wave antenna employs a special variety of set coupler to insure maximum efficiency at all frequencies or wave-bands. It is adjustable by means of two toggle switches on its top panel, as shown in the detailed sketch.

For reception in

(Continued to
page 138A)

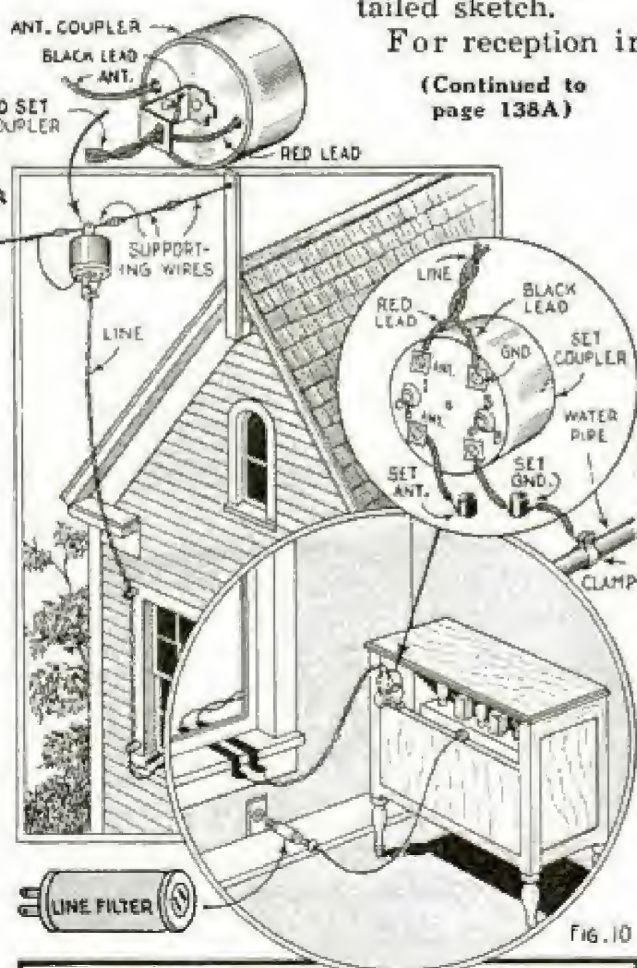


FIG. 10

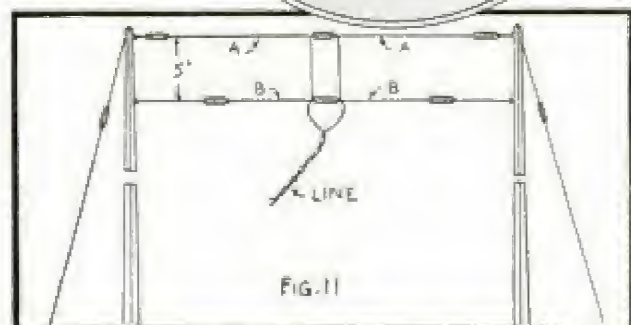


FIG. 11

£ 3592 Wright. Co
Coster Co

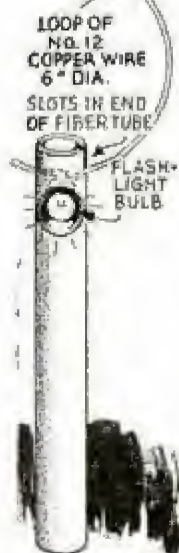
22 33
University Gen
H. Paul
Dunn

Hints for Radio Experimenters

Cabinet with Built-In Dynamic Speaker Designed to Meet the Demand for a Container of Proper Style and Proportion to House the Chassis and Matched Speaker of the "Browning 35," "All Star" and Similar Popular Short-Wave Kits and Circuits; Opening in Cabinet Is for an 8 by 16-In. Panel



Lead Washers Cut from Tooth-Paste Tubes, Placed under Mounting Screws of Porcelain Stand-Off Insulators, Prevent Cracking and Act as Lock Washers



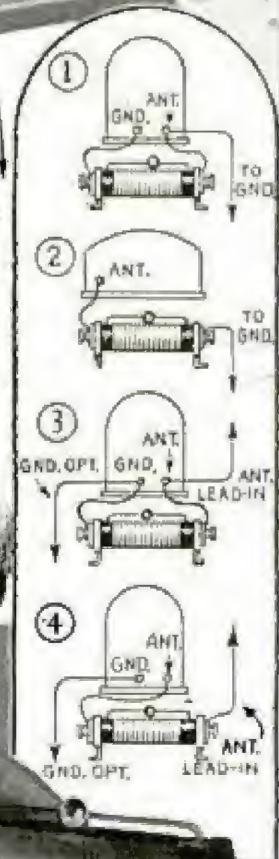
Left, Handy Radiation Indicator for Amateur Transmitter, Also for Neutralizing, as Very Small Currents Are Noted Easily by the Glow of the Miniature Filament in the Darkened Interior of the Fiber Tube



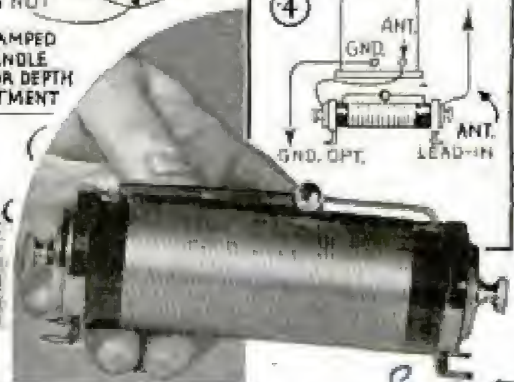
Above, Protective Cover over Terminal Strip Prevents Shocks and Short Circuit; Below, Stop Point for Rotary Knob; Multi-Point Switches Require Additional Notches



METAL STRIP CLAMPED UNDER DIAL-HANDLE SLOT FOR DEPTH ADJUSTMENT

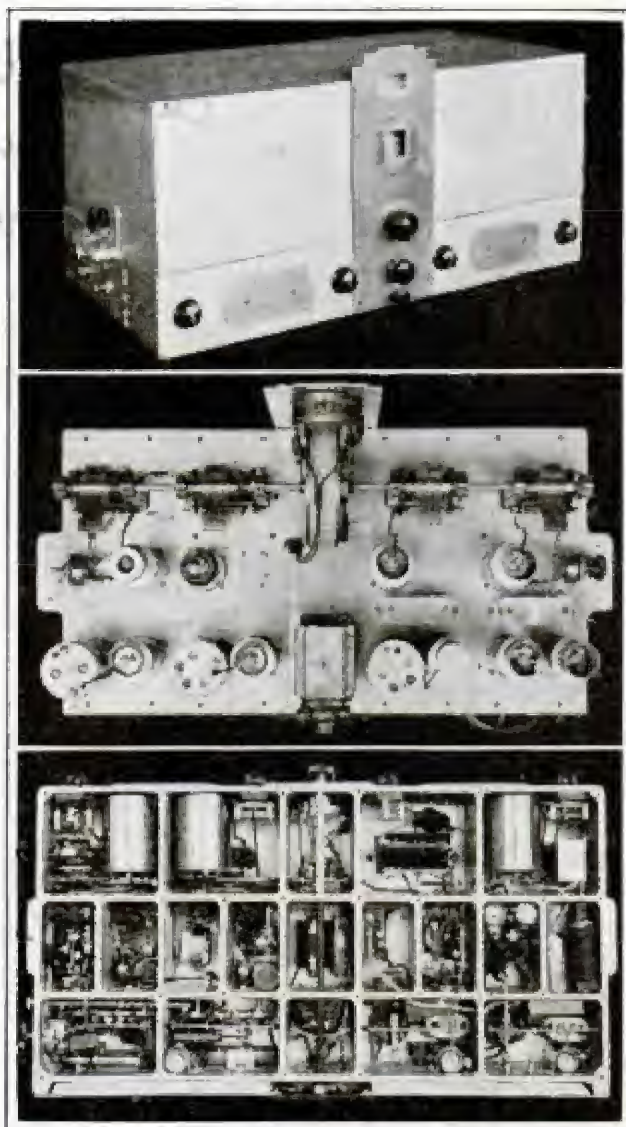


Adjustable Metal-Strip Safety Stop for Hand Drill, Limits Hole to Depth Desired and Also Prevents Damage to Parts Mounted inside Chassis When Drilling Holes for Additional Controls or Transformers



Antenna-Control Unit Acts as Aerial Eliminator, Antenna Tuner, Broadcast-Receiver Wave Trap and Station-Free-Spot Trap for Short-Wave Converter, When Connected in Sequence Shown Above

Insuline Corp of America
585
22 Paul Place



Above, Completed Tuner with Cast-Aluminum Chassis; Lower Photos Show Instrument Arrangement on the Base and Shielded Compartments Below

Super Tuner Has Cast-Aluminum Chassis

This de luxe eight-tube superheterodyne tuner was designed and built by a mechanical engineer whose hobby is home-made radio receivers. Unusually complete interstage shielding and rigid construction, resulting from the use of a cast-aluminum chassis, contribute largely to the electrical stability of the tuner and excellent noise-free reproduction from a separate audio amplifier. Separate power supplies are employed for the tuner and amplifier units. The tuner circuit consists of two tuned r.f. stages using type-58 tubes, a 57 modulator and 56 oscillator, two 58 i.f. stages, followed by two 55's in parallel, connected as a combined second detector and first audio stage. This audio stage is coupled to a type-59 in the separate audio amplifier, driving push-pull 245's in the output.

World Globe for Short-Wave Listeners

Two independently moving disks are fastened to the base of this world globe; one is a clock disk and the other logs all important short-wave broadcasting stations. They help the short-wave listener determine where a program is coming from, make calculation of time a matter of pleasant simplicity and show you when and what to dial. The 9-in. globe is a good size to fit on top of the average radio cabinet, or it may be placed on a table near the set.



Full-Range Test Oscillator Is Portable

A tuned-grid, plate-modulated circuit is used in this full-range test oscillator for service men. It has good stability over a wide range of voltage and climatic conditions. The output is modulated 50 per cent at 400 cycles. Two RCA 30 tubes are used, one as an r.f. oscillator and one as an a.f. modulator. Complete with one 22½-volt B-battery and one 4½-volt C-battery in a black-finished aluminum case, this portable unit weighs only five pounds.



Above, Rear View of Chassis Showing "B" and Filament Batteries under Base; Left, Test Oscillator Complete

Blueprints covering radio construction articles in past issues can be obtained for 25 cents each; when material lists are not included in the articles, these are available without charge on receipt of postage.

RCA Victor Co. Inc.
Camden, N.J.

AMATEUR MECHANICS



B. P. 878, 879.

MODEL OF

*Crusaders
Warship*

13TH. . . .
CENTURY

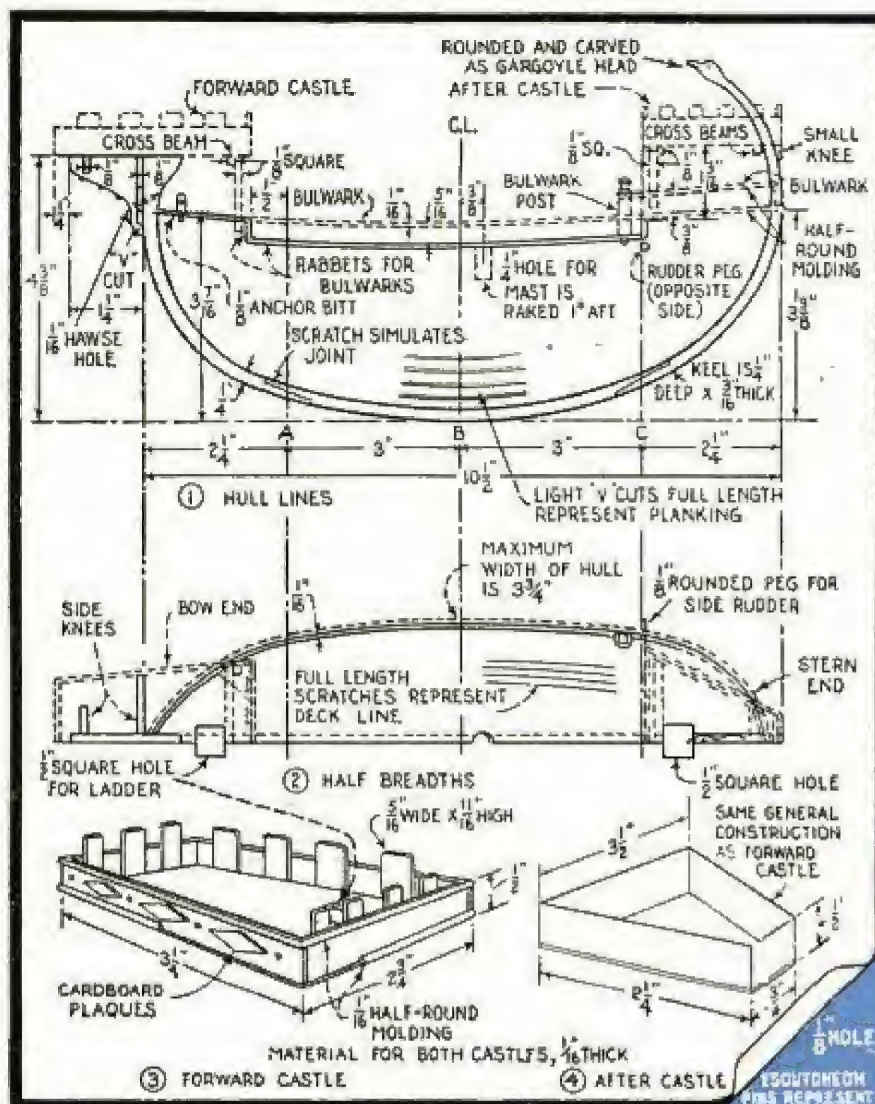
*by
Harold T. Bodkin*



HOW did King Richard, the "Lionhearted," transport his brave knights and their military followers from England to the Holy Land, there to clash in battle with the infidel Saracens? How did English armies reach the land of the Holy Grail? The building of this quaint ship model gives the answer—it represents a typical Crusaders' warship—and provides

you with one of the most novel ship models for your collection.

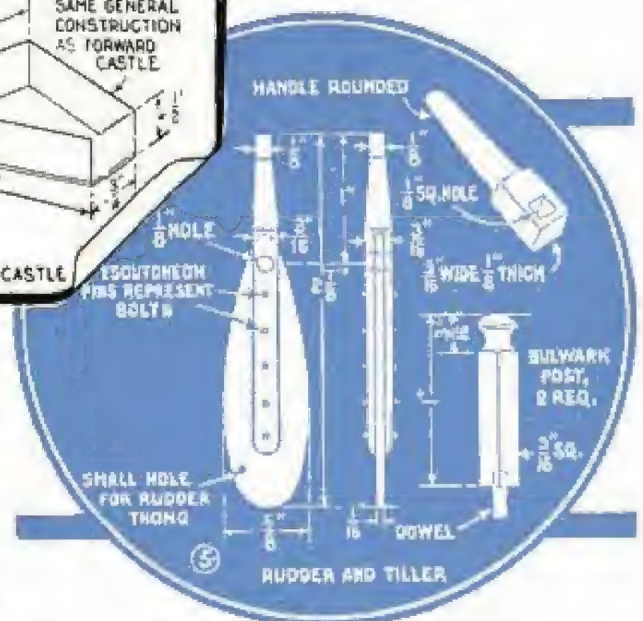
Keel is first. As shown in Fig. 1, the keel, stem and sternpost form one continuously curved piece, enabling you to cut the entire member from a single maple board, 11 $\frac{3}{4}$ in. long, 6 in. wide and $\frac{3}{16}$ in. thick.



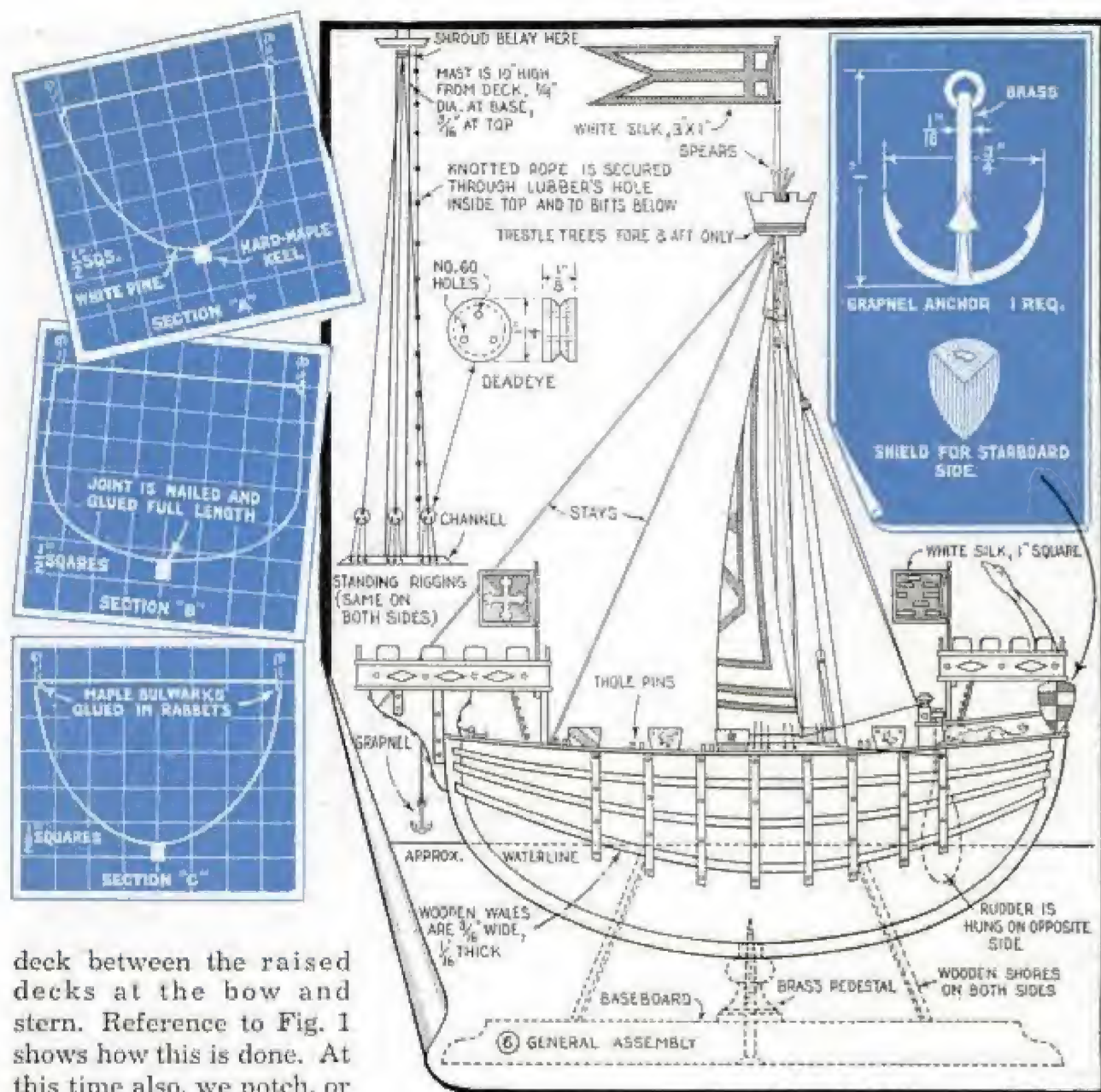
At the forward end, the large knees, which support the forward castle fore and aft, are cut as a part of the same assembly. V cuts make these parts appear as separate units as in real shipbuilding practice. The side knees, forward, are cut from the waste of the same hardwood board. Fig. 1 is drawn full size and transferred to the board with carbon paper.

The hull proper is carved from a solid white pine block, $10\frac{1}{2}$ in. long, $3\frac{3}{4}$ in. wide and $3\frac{1}{16}$ in. thick. If stock of this thickness is not available, two pieces may be glued together with waterproof casein glue, along the centerline of the model. Now, using the cut-out, finished keel piece as a curve, a penciled mark is drawn on the side of the square block to indicate the curve of the hull, fore and aft, as it contacts the inside edge of the keel. It is best to saw the hull block just a little outside of the mark and, later, to file and sandpaper the hull down to a close fit with the keel piece. Next, thin plywood or

cardboard templates are made to match the three hull sections, A, B and C. The half breadths, Fig. 2, show the outline of the main deck of the ship. Another cardboard pattern is now traced and cut to this outline and the curve is then transferred to the top side of the hull block. Only half the deck is shown in Fig. 2, the other half being an exact duplicate. This curve is likewise cut just a trifle larger and, when it is sawed thus, the block assumes the rough hull shape. Now we begin carving the hull. Section lines "A," "B" and "C"



are first drawn in their respective locations on both sides of the block. A small spoke shave is used to cut away the waste stock and to shape the hull to the rounded sections. The templates are used as guides. Do not attempt to cut down the hull at any one section to the finished size. Instead, it should be carved little by little at each point until nearly completed. The final smoothing is done with coarse and fine sandpaper, checking meanwhile with the keel piece to make sure of a perfect fit. Thus far, we have not cut down the top of the block to provide for the lower main

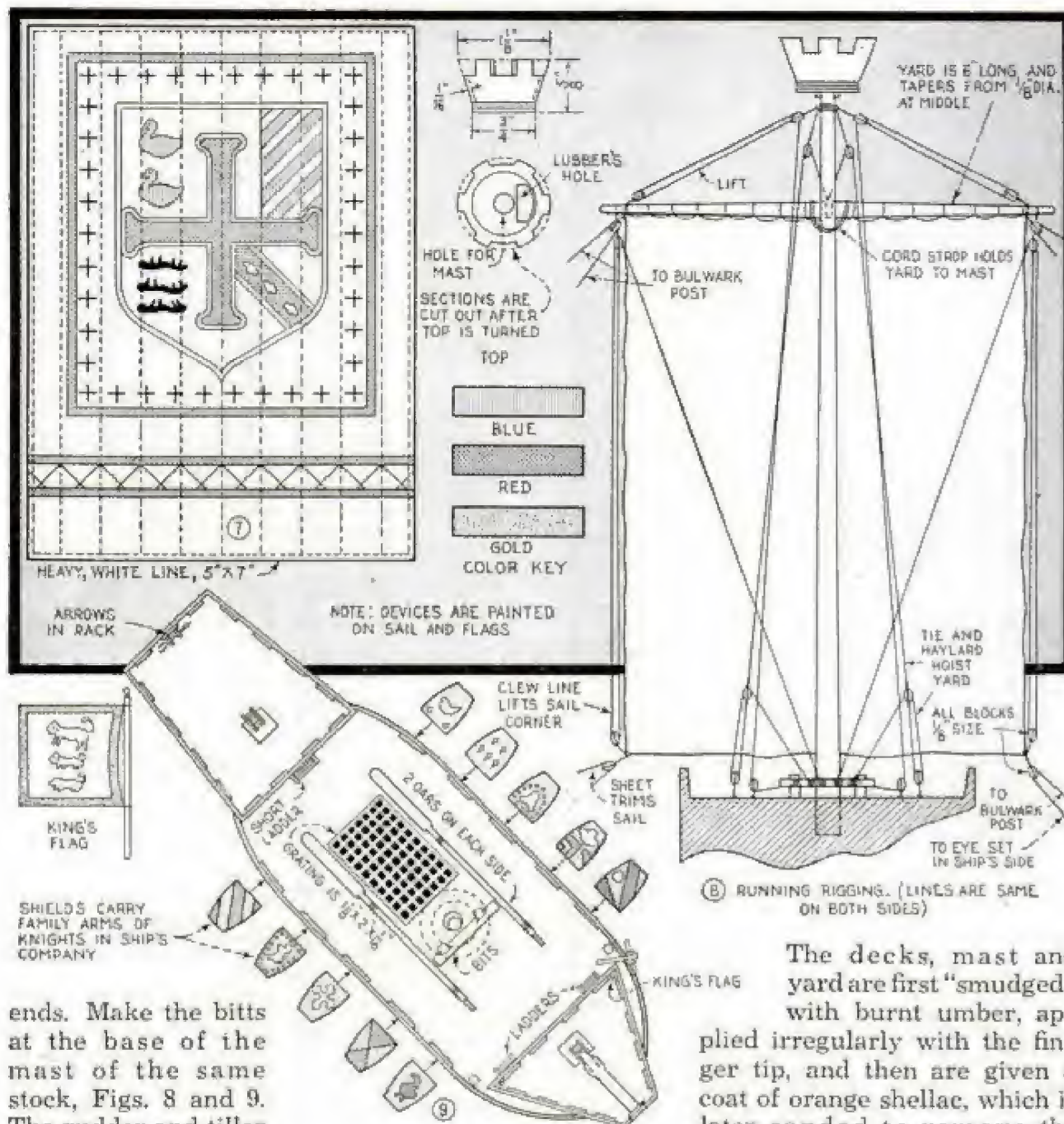


deck between the raised decks at the bow and stern. Reference to Fig. 1 shows how this is done. At this time also, we notch, or rabbet, the carved block to provide for the bulwarks, which are now made and glued into them. When the glue has dried, the hull and bulwarks on both sides are sanded to assure smooth joints. The keel piece is nailed and glued along the centerline of the block, as in Fig. 1.

There are no bulwarks on the forward deck, but bulwarks are fitted flush on top of the outside edges of the after deck. See Figs. 1 and 5. It may be necessary to steam these thin pieces just before they are applied, to prevent breaking. The after ends of these bulwarks fit flush against the sternpost; the forward ends are secured to bulwark posts on each side. These posts are made as detailed and doweled into the deck at the locations shown. Then, $\frac{1}{8}$ -in. half-round moldings are fitted and, if desired, scratches are made in the decks and

hull sides, Figs. 1 and 2, to simulate plank-ing lines. A $\frac{1}{4}$ -in. hole is also drilled in the main deck for the mast, care being taken that the hole is properly located and drilled at the correct "rake" toward the stern. The anchor bitt is merely a section of $\frac{1}{8}$ -in. dowel with a cut-off pin passed through just under the top. It is glued into a hole in the forward deck and projects about $\frac{1}{2}$ in. above the deck. In line with this, a $\frac{1}{16}$ -in. hawse hole is drilled through the stem, slanting downward as shown in Fig. 1. The rudder peg is set in the right side.

Forward and stern castles are merely box-like units, made and fitted as in Figs. 1 to 4 inclusive. They are glued and nailed in place, $\frac{1}{8}$ -in. vertical posts and cross beams being fitted to support their free



The decks, mast and yard are first "smudged" with burnt umber, applied irregularly with the finger tip, and then are given a coat of orange shellac, which is later sanded to remove the gloss. If you prefer, you may

also paint the sail, Fig. 7, and the various flags and shields according to the color key given.

The five tiny ladders, shown in Figs. 6 and 9, are made of berry-box stock, steps being glued flush against the upright pieces. The grating, oars, anchor, spears and arrows, with racks, are shown in proportionate sizes and you should have no difficulty making and installing these in the places indicated. The two forward mast stays, the climbing rope and the shrouds of the standing rigging are triple-thickness (three strands) of No. 30 black linen thread, waxed before applying. All running rigging, Fig. 8, is the same in sin-

ends. Make the bitts at the base of the mast of the same stock, Figs. 8 and 9. The rudder and tiller are made as detailed in Fig. 5, hardwood being preferred. The single mast is 10 in. high above the deck, (extra length being provided for sinking into its hole) and is $\frac{1}{4}$ in. dia. at the bottom, tapering to $\frac{3}{16}$ in. dia. at the top end. A "top" is made as shown in the detail on the right of Fig. 7, and is fitted at the upper end of the mast. The yard, Fig. 8, may also be made at this time, but it is put in place when we "bend on" the sail. Four sets of $\frac{1}{16}$ -in. thole pins are set in the bulwarks as shown.

Painting is the next step. The outside of the hull, keel piece, castles and rudder are painted with walnut brown japan color. The insides of the bulwarks are the same.

gle thickness. The blocks used are all of the standard $\frac{1}{8}$ -in. size obtainable from ship-model supply houses, which also stock the standard $\frac{1}{4}$ -in. black deadeyes used for the shrouds. The lanyards between shroud deadeyes are No. 30 linen thread. The rudder, with tiller in place, is hung on the peg in the hull, a turn or two of thread at the end of the peg being used to hold the rudder from slipping off. As another safeguard against losing the rudder, the ancient sailors passed a loose thong from its forward edge to some timber inside of the main deck bulwarks. This is represented by a length of double-strand No. 30 thread in the model.

The ship itself is now complete but an attractive, safe base is still needed to display and protect the model from damage. The exact type of base is optional. However, the drawings show one style—with walnut baseboard—that is nicely adapted to the purpose. The brass pedestal can be had from model supply concerns.

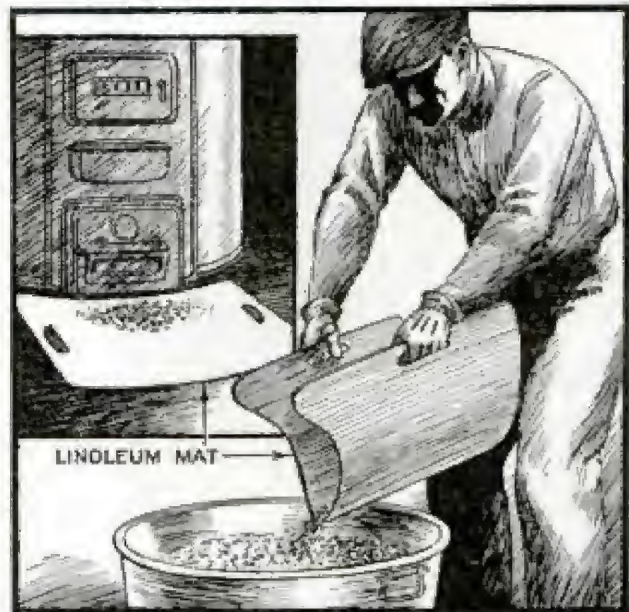
Auxiliary Weights Act as Formula

In mixing photographic chemicals, considerable time can be saved by using a set of auxiliary lead weights. Such weights may be made up of ordinary sheet lead, each piece representing the exact weight of one chemical called for in the formula. They should be placed in a recessed holder to prevent the possibility of becoming disarranged, and labeled as indicated.



Lead Weights Used in Weighing Photographic Chemicals Save Time and Eliminate Mistakes

Linoleum Mat Catches Spilled Coal and Ashes



Laid in Front of the Furnace, a Piece of Linoleum Is Handy for Catching Ashes and Spilled Coal

By cutting a piece of discarded linoleum to fit in front of the ash door of a furnace, you may eliminate frequent need of a broom for sweeping up broken coal or ashes that are accidentally spilled. By lifting the mat by the two hand holes cut at the ends, the contents may be quickly poured into the ash can.

Rubber Hose Protects Thermometer against Breakage

In storage houses, where many thermometers must be used to record the temperature in various parts of the building, the instruments are often accidentally dropped and broken. To prevent repetition of such expensive accidents, a wholesale meat dealer had each thermometer inserted into a length of rubber hose, cutting out the rubber at one side to allow easy reading. A small hole through the upper end of the hose permitted it to be suspended from a hook on the wall.



"Fence" of Wire Solder Holds Small Parts on Stepladder



Worker Uses Wire-Solder Ring to Hold Small Parts on Top of Stepladder

To prevent screws, nails and other small parts from rolling off the tray of a stepladder, when assembling electrical fixtures, one workman uses wire solder, which he shapes into a ring as shown. Also, the wire may be bent or looped to hold the screwdriver, lamp bulbs or other tools and accessories.

Improved Handle for Photographic Lamp

Bushings in the handles of low-priced combination hand and tripod lamps, which are so popular with amateur photographers, are apt to get loose after considerable use and no longer hold the lamp firmly on the tripod. This trouble may be



overcome by making a hardwood handle for the lamp with the end shaped to take a strong ferrule somewhat larger than the bushing. After the ferrule is driven on the handle a hole is drilled in the wood. This should

be slightly smaller than the bushing, which is then driven into the hole. The ferrule keeps the wood from splitting, thereby allowing the bushing to be fitted much more tightly than is the case with a new lamp.—Guy A. Rafuse, Bridgewater, N. S., Can.

Typewritten Lantern Slides

Typewritten lantern slides can be made quickly from materials available in any home, using Cellophane and carbon paper. The latter will give a good deposit on the Cellophane. To get as heavy a deposit as possible, select a piece of new carbon paper twice the size of the slide, fold it pigment side in, and slide the Cellophane between the folds. Type on the paper, with the ribbon removed from the machine for clearness. The Cellophane is then bound between two pieces of glass for protection. Colored Cellophane may be used for special effects.



Envelope on Calendar Saves Sheets for Reference

In the home or office, records of temperature, rainfall, etc., are frequently kept on the calendar sheets. To preserve these where they will be available when wanted, fold back the gummed flap of an envelope and paste it against the back of the calendar. This will provide a convenient pocket into which the sheets may be placed as they are removed.

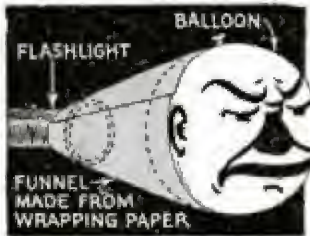


Bathing Suit Stored in Jar

A successful method of storing a bathing suit for the winter is to first wash it thoroughly and allow it to dry. Then place the suit in a fruit jar and seal it tightly. Next season you will have a bathing suit free of moth holes without the odor of moth balls.

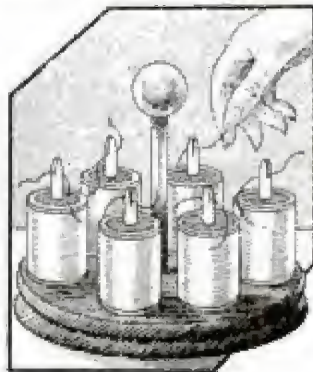
Toy Balloon and Flashlight Make Jack-o'-Lantern

A safe and cheap jack-o'-lantern for halloween night may be made from a toy rubber balloon, a pocket flashlight, and a sheet of wrapping paper. Roll the paper into a cone around the flashlight and fasten it with paper tape. Inflate the balloon to a size which will allow it to be forced snugly into the large end of the cone, and then paint features on it with black ink as shown. Flashing of the light causes the head to be illuminated with a ghostly glow, revealing the painted caricature on the balloon.



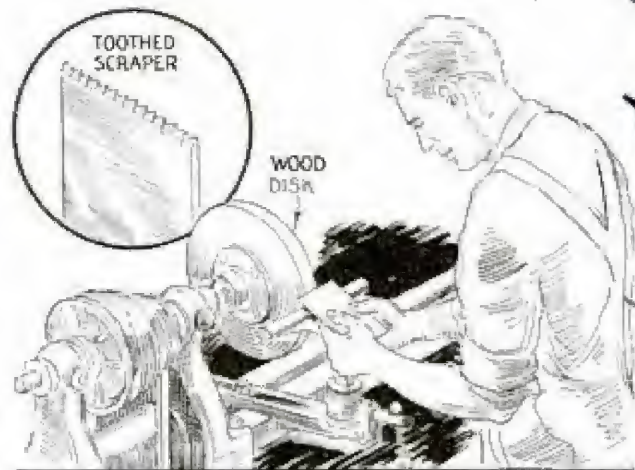
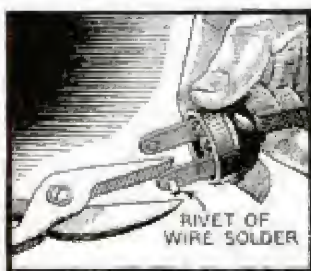
Novel Spool Holder to Keep Thread Ends Handy

To eliminate the usual inconvenience of thumbing a spool to locate the thread end, one amateur craftsman devised the spool rack shown. The novelty of the device is in the spool spindles, each of which is provided with a split top into which the thread end of the spool may be drawn to keep it ready for instant use.



Instant Repair for Loose Attachment Plugs

When the spring contacts of a wall outlet fail to hold the prongs of an attachment plug securely, cut two short pieces of wire solder and insert these through the holes of the prongs, as shown. When clinched with a pair of pliers, these improvised rivets will make the plug prongs fit snugly into the spring connections.



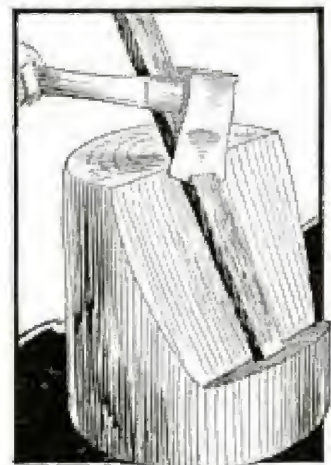
Wood Disks Turned Smoothly by Using Toothed Scraper, Which Is Made of Steel

Toothed Scraper Smooths Edges of Turned Work

Amateur woodworkers who have had difficulty in turning the edges of wood disks smooth along the end grain, even with a very sharp skew chisel, will find that a toothed scraper solves this problem nicely. Scrapers of this type have a series of parallel flutes ground into one surface. When the scraper is beveled a series of teeth are formed. Though not a common tool, this type of scraper can be obtained from the larger tool-supply houses at a nominal cost. In use, the tool rest of the lathe is set at center height and the scraper moved back and forth on it, in contact with the work as it rotates.

Beveled Chopping Block Helps to Eliminate Accidents

According to a Wisconsin woodworker, kindling may be cut on a beveled block without danger of an injury from flying pieces or splinters. An ideal block for this purpose is a short piece sawed from the end of a large log with one side beveled as shown, leaving a projection on which to rest one end of the work.



☛ To keep starch from sticking, add a little paraffin to it.

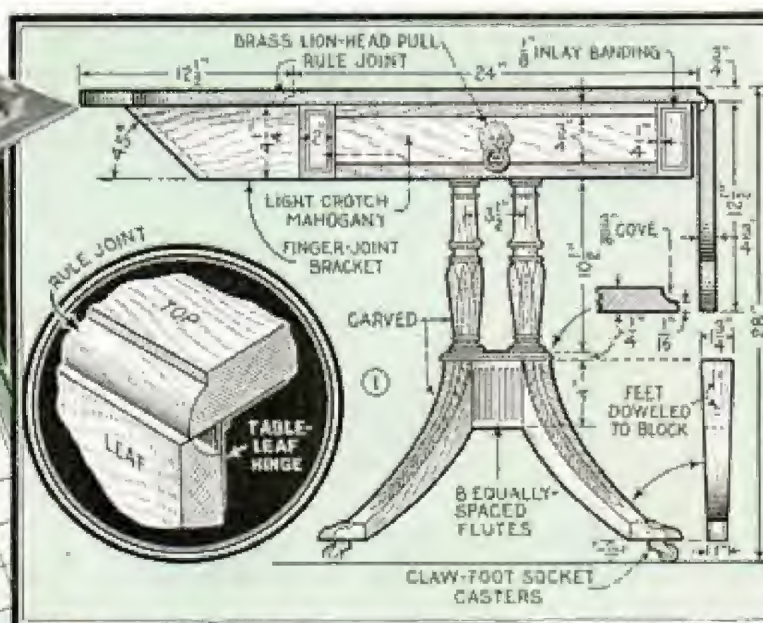
*Woodworkers Tool Works
222 S. Jefferson
Chicago*

Duncan Phyfe DROP-



orate. The table has the characteristic concave feet, ornamented with the distinctive Phyfe leaf carving and, in other respects, shows beyond a doubt that it is the work of this master cabinetmaker.

Construction of the table may properly start with the top, which is best made of solid stock because of greater ease in finishing the edges, although built-up stock with veneered edges, as is customary in production work, is feasible. Dimensions for the top and leaves are given in Figs. 1 and 2. Mahogany was used almost exclusively by Phyfe and it is the wood used



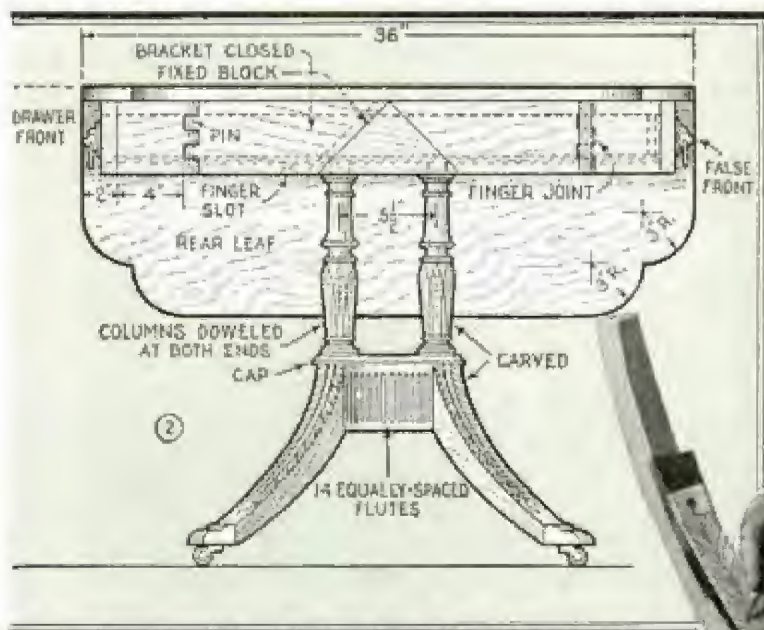
for this table. Phyfe is described as going down to the wharf whenever a shipload of Honduras mahogany logs arrived, to select the very finest figured material. The logs selected he had transported to his own yard where they were seasoned for a full year before the material was used. While such material is not procurable nowadays, care should be taken to select well-matched, fine-figured pieces for the top and leaves. The latter have quarter-turned ends but all edges are left square with the exception of the hinged ones. A rule joint and long table hinges are used to fasten the leaves in place as shown in the detail of Fig. 1. The top frame on the

DUNCAN PHYFE, who was America's first designer and builder of furniture of merit, apparently was the only builder of early American furniture to develop a distinctive style by which his designs may be recognized easily. The drop-leaf table pictured, which is owned by the Metropolitan Museum of Art, but loaned to the New York State Historical Association at Ticonderoga, is considered one of his finest pieces, though far from his most elab-

LEAF TABLE *by R.O. Buck*

original table does not have a drawer, but has false drawer fronts and pulls on each end. Though this simplifies the construction somewhat, the drawing deviates from the original to the extent of including a drawer, as shown in Fig. 3.

Square corner blocks are joined to the side and front rails by means of mortise-and-tenon joints in the original, though dowel joints will serve. The corner blocks are made of solid stock and



carry a rosewood banding on one face of each as shown in Fig. 4. Screw pockets are cut in the long side rails and screw holes are cut in the short end ones to fasten the top in place. The screws should be a loose fit in the holes to allow for expansion and contraction of the top. The long rails are set $\frac{3}{4}$ in. in from the face of the corner blocks to allow for housing the finger-joint brackets, which support the leaves. The spacer pieces, drawer slides and bottom rails are shown in Fig. 3. Across the bottom, at the center, a piece of hardwood is mortised firmly to the bottom rails. Holes are drilled in this piece to house the tenons on the four columns

which form the pedestal. The drawer, shown in Fig. 5, is made with the usual type of construction but with the addition of a slide groove cut into each side piece. Dovetail joints on the front corners are in keeping with the period. A piece of light-colored crotch mahogany should be selected carefully for the drawer front and the false front on the opposite end.

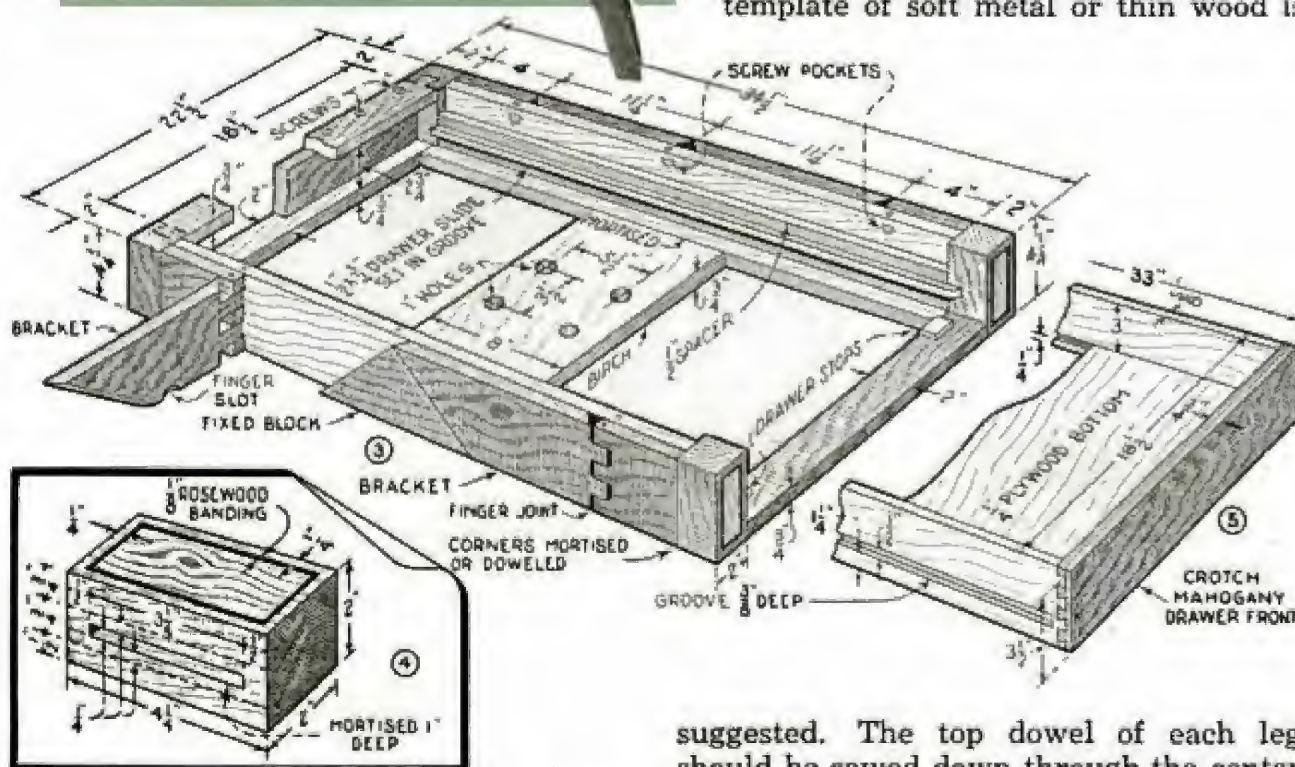
The bracket assembly consists of the





$\frac{1}{16}$ in. is left at each end of the joint to prevent binding. A long finishing nail or stiff piece of wire about $\frac{1}{16}$ in. in diameter is used for the pin. A hole of the proper size should be drilled, preferably on a drill press, to assure accuracy, before the pin is driven into place. To prevent the bracket from binding at the front, the edges are beveled off at an angle of 45° . A finger hole is also formed with a gouge at the bottom. To prevent the bracket from striking against the rail, which is directly back of the joint, the shoulders are beveled off from the inside with a sharp chisel. The inner corners of the bracket fingers are also rounded. Both glue and screws are used to fasten the fixed parts of the bracket assembly to the rail.

The turned columns, four of which are required, are detailed in Fig. 6. Care must be taken to make these as nearly identical as possible. Use of a template of soft metal or thin wood is



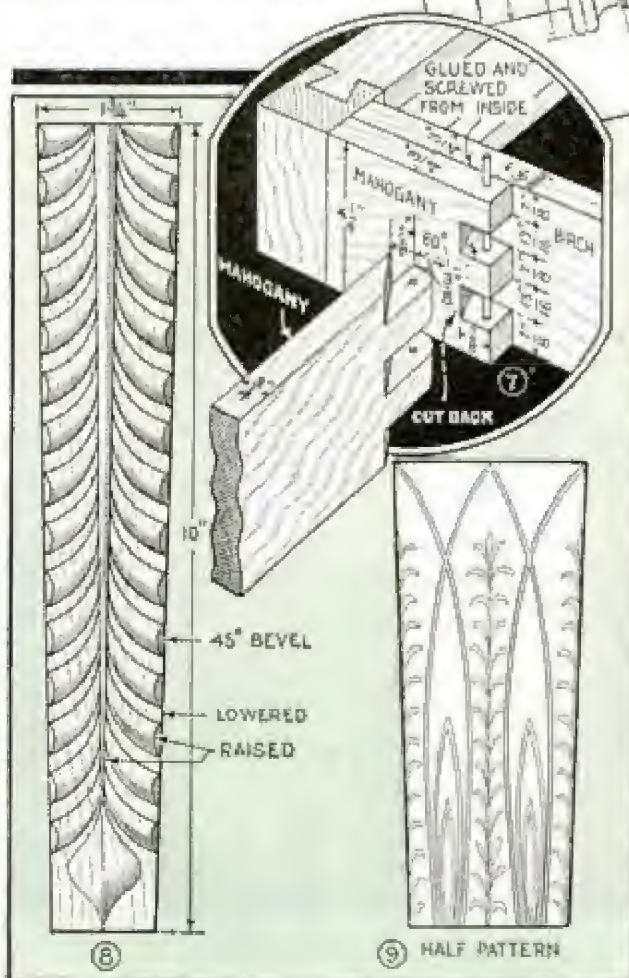
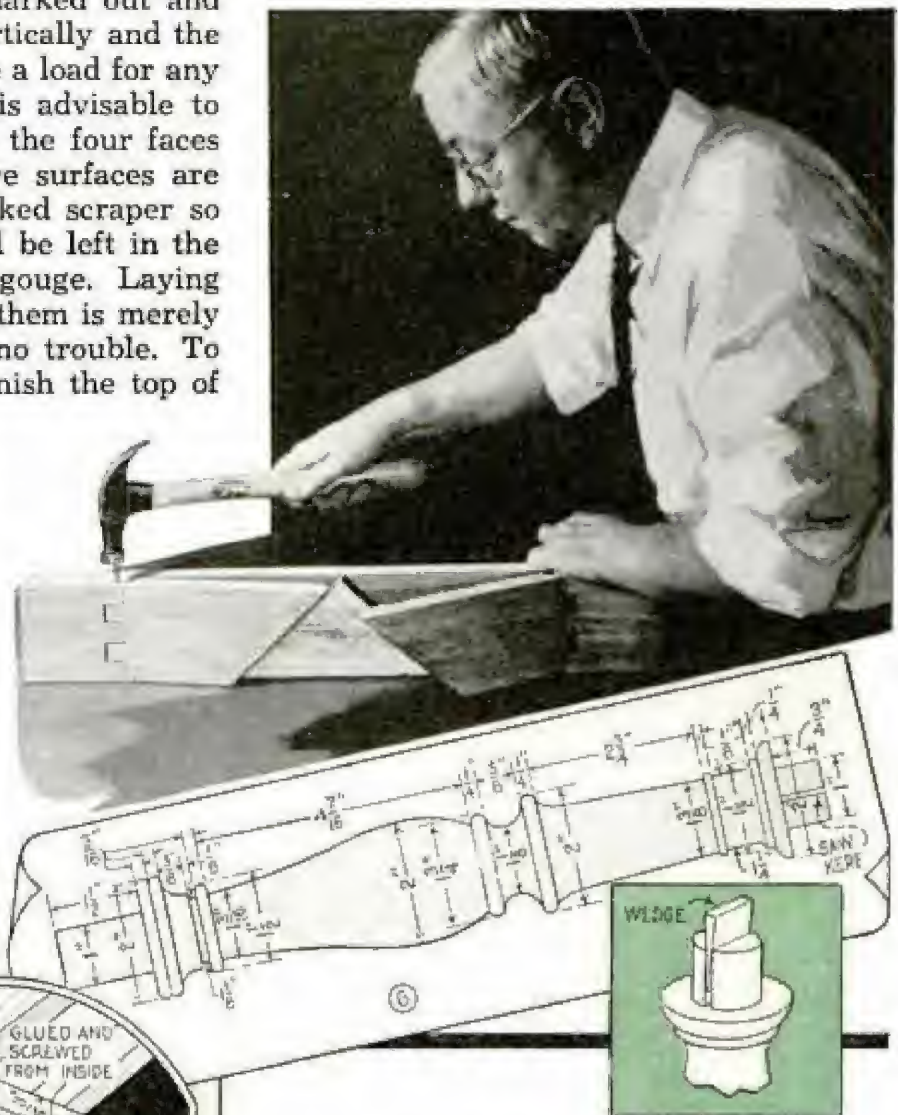
brackets, end blocks and triangular center piece, which are sawed from a single piece of stock. This should be cut long enough to allow for the finger joints, so that the grain will match the entire length. The lay-out of the finger joints is shown in Fig. 7. The joints are carefully marked out with a knife point and cut so that they will fit together snugly. A clearance of

suggested. The top dowel of each leg should be sawed down through the center so that a wedge, as well as glue, may be used to fasten them securely in holes which are drilled in the piece at the bottom of the frame. This should be done on a drill press, if possible, so that they will be absolutely vertical.

The pedestal block, shown in Fig. 10, is built up with thick veneers of mahogany over a soft-wood core. After the glue is dry and the piece has been squared up, the

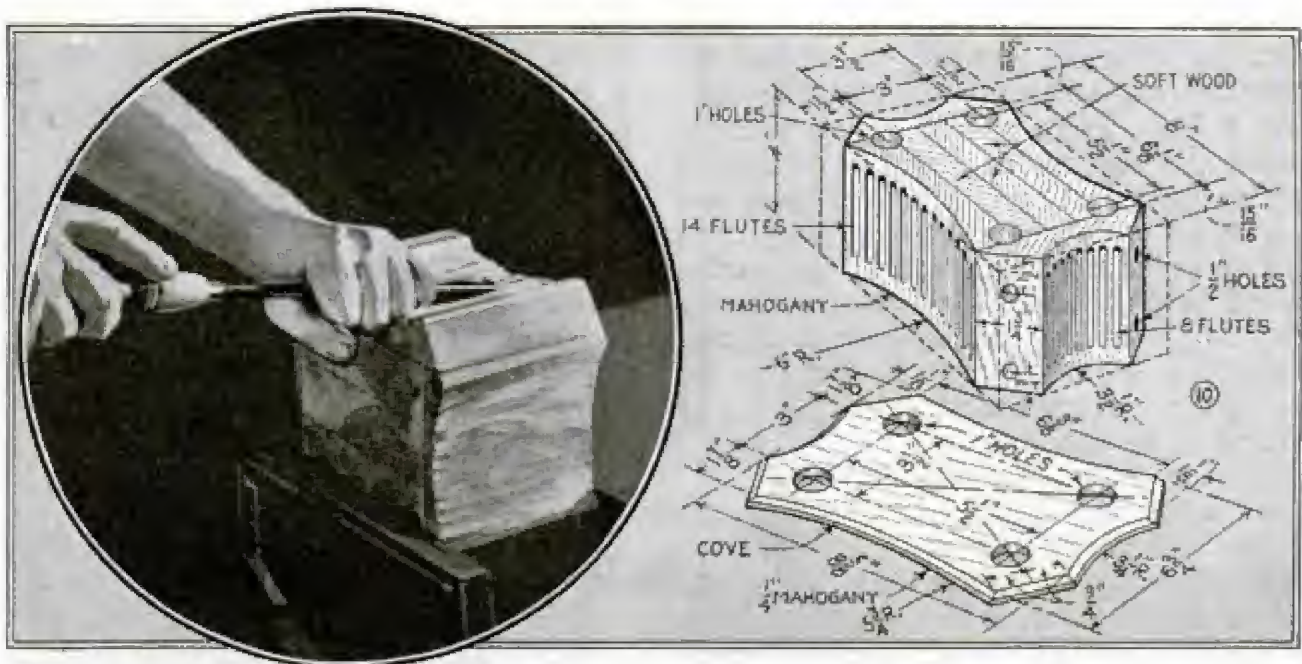
corner bevels should be marked out and cut. As the grain runs vertically and the span is 4 in., which is quite a load for any but a large band saw, it is advisable to make the concave cuts on the four faces with a gouge. The concave surfaces are smoothed with a goosenecked scraper so that no sandpaper grit will be left in the wood to dull the carving gouge. Laying out the flutes and cutting them is merely routine and should cause no trouble. To cover the end grain and finish the top of the pedestal block a $\frac{1}{4}$ -in. cap is used. Perhaps the easiest way, though not entirely orthodox, to cut the small cove on the edges of this piece, is by the use of a small rat-tail file, followed by a bit of sandpaper wrapped over a piece of $\frac{1}{4}$ -in. dowel rod.

Referring to the detail at the left side of Fig. 1, a full-size pattern of the concave foot should be made from the squared



detail. The stock should not be tapered until the dowel holes, which fasten the feet to the pedestal block, have been drilled as it is difficult to hold the piece in a vise after it is tapered. A metal dowel jig, such as shown in the photo above Fig. 3, will be found convenient for drilling the dowel holes true, or an accurate wood jig may be made for the purpose. Drilling them on the drill press is also a good method.

There is little doubt that the carvings on the legs and columns of the original greatly enhance the beauty of the piece. However, poorly executed carvings cannot be considered an asset. For this reason, unless you are somewhat adept at wood carving, it is suggested that you simply flute or reed the legs and leave the columns plain. Fig. 8 shows the conventionalized leaf design that Phylfe used on the feet. A full-size pattern should be worked out on stiff paper and the design transferred to the pieces by means of car-



bon paper. A flat pattern of the column carving is shown in Fig. 9. This pattern reaches halfway around the column and is transferred to the stock by the following method: One of the turned columns is covered with a layer of slightly moistened tissue paper, cut into strips $\frac{3}{4}$ in. wide, after which a layer of gummed paper about the same width is pasted over the tissue to form a layer just sufficiently thick to hold the shape of the turning. Then the design is worked out on the gummed paper form after which the form is split with a sharp knife and removed. The purpose of the tissue, of course, is to prevent the gummed paper from adhering

to the wood. Carbon paper may now be wrapped around the column, the paper forms replaced and the pattern traced. Rubber bands are convenient for holding the form in place. The same form pattern can be used for the other three columns to produce an identical design on each. The carving on the columns is quite shallow but clean-cut and sharp.

The brass, claw-foot socket casters, lion-head pulls and leaf hinges can be obtained from supply houses handling antique-furniture fittings. The piece is finished in a reddish, brown-mahogany color and rubbed to a dull sheen with pumice stone in the usual manner.

Fence of Hairpins Improves Appearance of Model Railway



Hairpins Inserted through Thin Strips of Wood Provide a Miniature Fence Which Adds to the Appearance of Your Model Railway

An effective method of adding to the realistic appearance of your model railway is to use this miniature "iron" fence. This is made of hairpins, which can be purchased for a few cents in sizes to suit the proportions of your model. The rails of the fence are thin strips of soft wood, preferably balsa, through which the pins are inserted. If balsa is used, two strips can be stacked and the pins pushed through them, after which the strips may be spaced and glued to posts.

❑ The use of shale, slate, soft limestone, and any other material that crumbles, splinters, or peels off should be avoided as an aggregate in concrete.

Initial Your Playing Cards with This Process

Placing your initials or monogram on the backs of playing cards, and printing small address labels and other forms, is done easily by a process which produces results similar to lithographing or offset printing. The process consists of preparing a gelatin-surfaced plate from which the impressions are taken in a manner similar to hectographing, the difference being that any color of ink can be used, and the impressions are much sharper. To make the plate, cut a sheet of thick glass to the exact size of a playing card, and give the surface a mat finish by grinding it with emery powder. Then fit it into a block of wood so that the glass is flush with the surface. Next, soak a sheet of gelatin in cold water until it swells, after which it is melted. Pour the gelatin over the surface of the glass and allow it to dry in a level, dust-free place. In the meantime, the initials, or monogram, are made on a small sheet of bond paper with a pen and a saturated solution of potassium bichromate in water, and allowed to dry. If the solution flows too freely, add several crumbs of gum arabic. If necessary, a pointed brush may be used to fill in parts of the lettering. With a soft sponge, gently wet the surface of the gelatin, sponge off the surplus water, and place the drawing face down on the plate, rubbing it into contact with the gelatin the same as with hectograph. After a minute, you can gently strip off the paper. Allow the gelatin to dry in a bright light, and the plate is ready for use. The plate is sponged again, this time using equal parts of water and glycerin. The initials will refuse to accept the solution, while the remainder of the gelatin will swell. Wipe off the excess solution and ink up the plate with a composition roller, using a greasy ink of any color. It will "take" only over the initials, the remainder of the plate repelling the ink. If any should show on the plain gelatin portions, they have not had enough water and glycerin. The actual printing



operation consists of laying the back of a card on the inked plate, and then pressing it into firm contact with a roller. Glycerin and water must be added occasionally to keep the gelatin in its swelled condition.

Heating Rooms with Gas Stove

Many use the gas-stove oven as a source of heat on chilly mornings. To do a speedy and thorough job of warming a room in this way, a small electric fan may be placed on the oven door. This will draw warmth from the oven and drive it to the farthest corners of the room. Also, a fan placed to blow air across a steam or hot-water radiator helps distribute the heat.

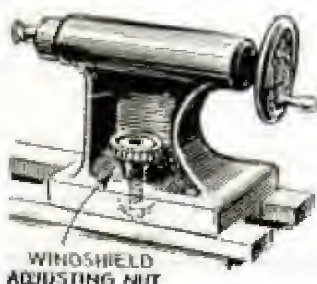
Diagonal Cuts to Center Lathe Work Made on Your Band Saw



Using Your Band Saw to Cut Diagonals in End of Work to Be Turned in a Lathe

Your band saw is convenient for making the diagonal cuts in the ends of work you are preparing to turn between centers on the lathe. Make a V-block of suitable size and on the bottom of this piece attach two angles of light sheet iron spaced so that they will fit snugly in the saw-table slot. A wide slot should be cut in the bottom of the block so that the horizontal legs of the angles come flush with the surface. Also, a pair of stop pieces, made of any scrap metal, should be provided to hook over the edge of the saw table so that the block will not be fed into the saw. In use, the work is pushed against the moving saw, then removed and given a half turn for the second cut.

Windshield Nut Is Handy to Adjust Lathe Tailstock



WINDSHIELD
ADJUSTING NUT

Difficulty sometimes experienced in loosening and tightening the adjusting nuts on the tailstocks of some small woodworking lathes may be

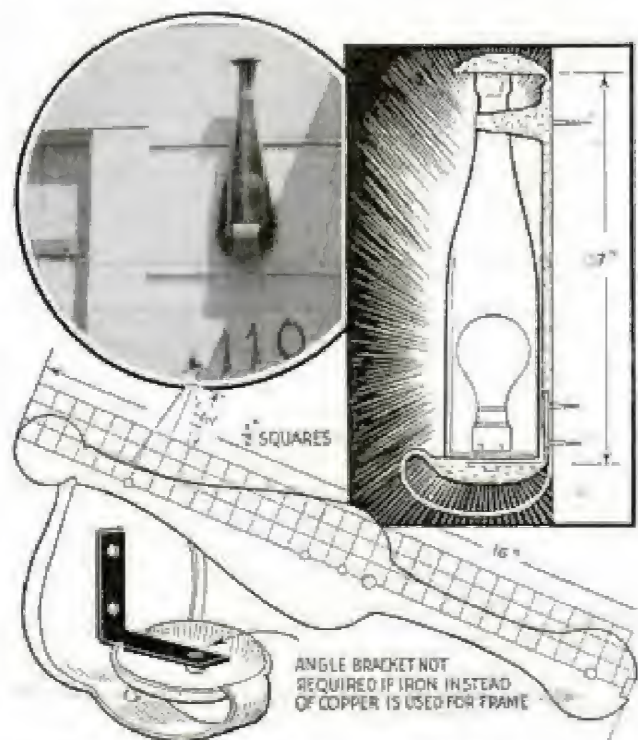
eliminated by substituting a nut from the windshield of a car for the regular adjusting nut. Many of these nuts are knurled so that they are turned easily with the fingers, and most of them will screw onto a carriage bolt, which can be purchased to fit in the lathe bed and tailstock.—Frank Bentley, Missouri Valley, Ia.

Playing Cards Cleaned with Camphor

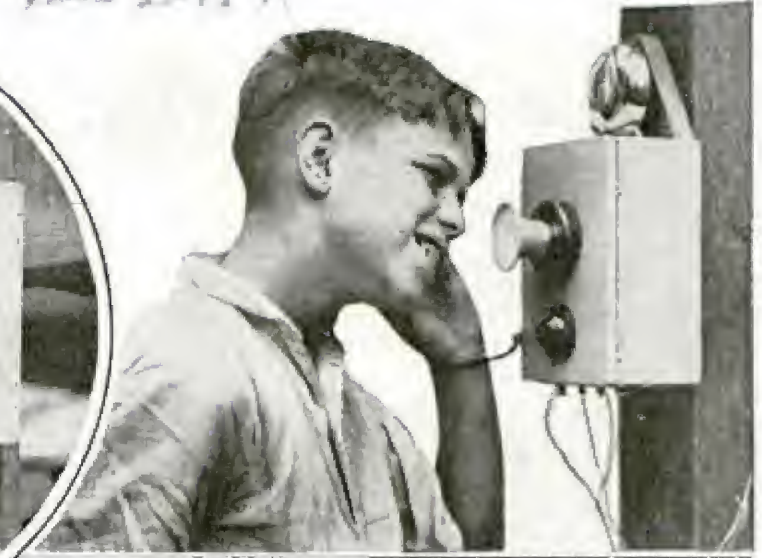
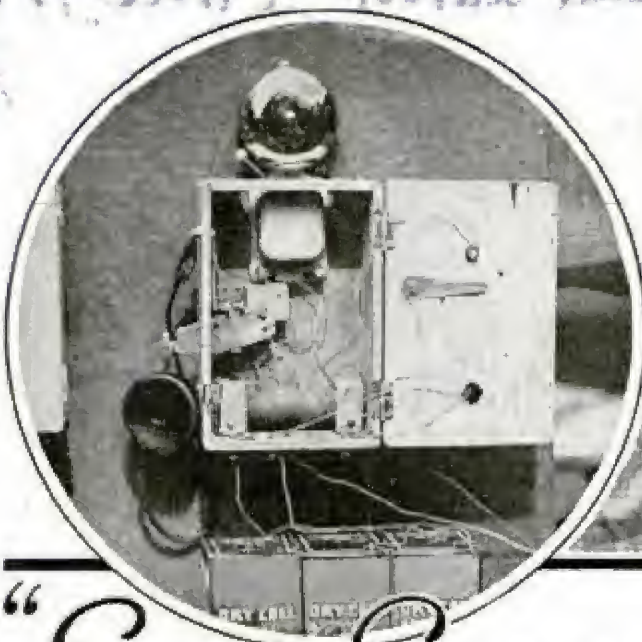
When playing cards become soiled and sticky from much use, they can be renewed to a considerable extent by cleaning with spirits of camphor. This should be applied sparingly with a small piece of cotton, wiping each side of the card thoroughly. Afterward, polish the cards with a wad of clean cotton or a soft cloth.

Interesting Porch Light Made from a Wine Bottle

Fitted in a wrought-iron or hammered-copper bracket, a colored wine bottle makes a very effective porch lamp. The bottom of the bottle is cut off about $\frac{1}{2}$ in. from the end. The squared diagram gives the profile of the pattern for the bracket. If soft copper is used, it will be a good idea to support the weight of the bottle and bulb with an angle bracket as shown in the lower detail.



Attractive Porch Light Made by Using a Hammered-Copper Bracket and a Wine Bottle

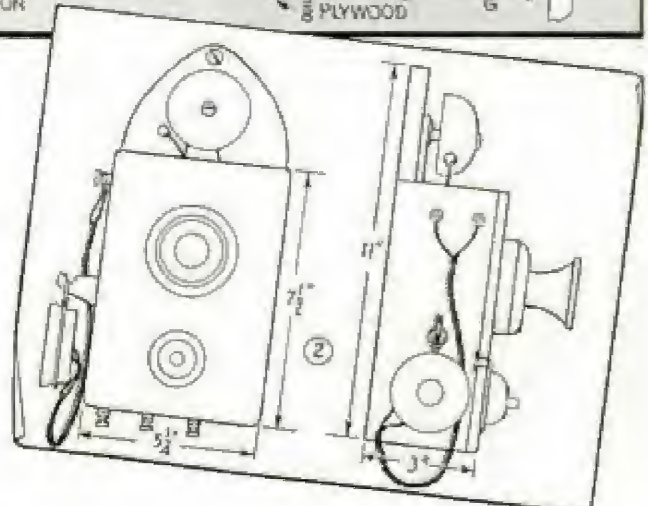
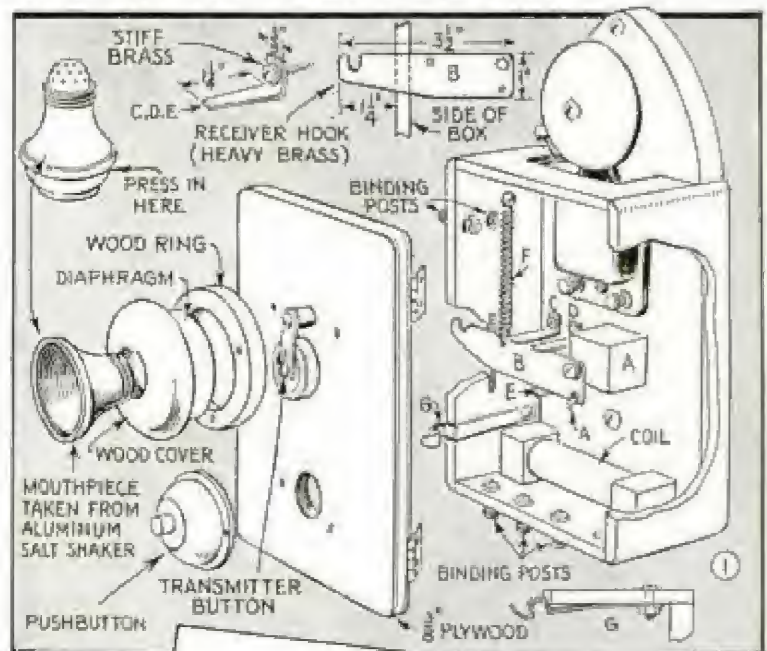


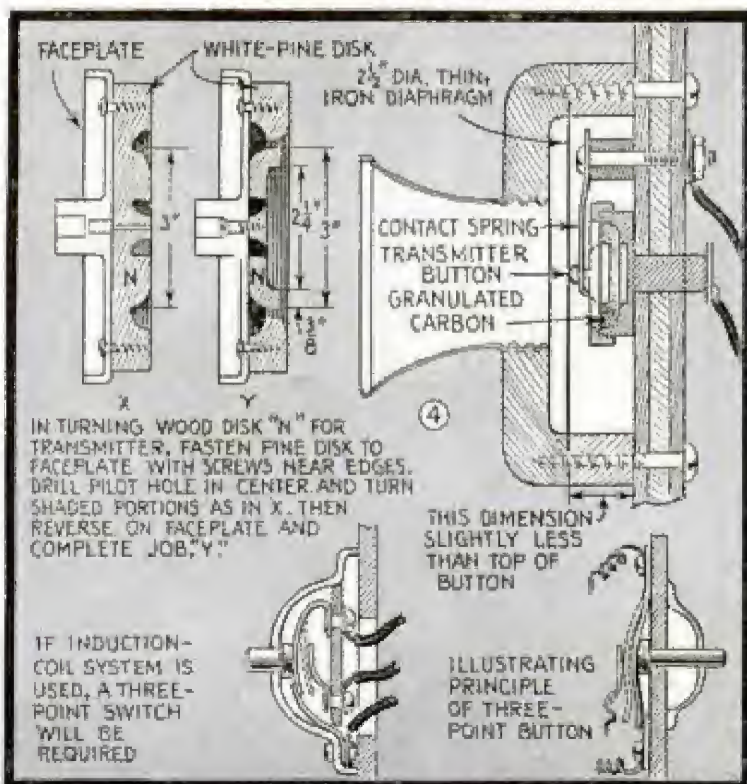
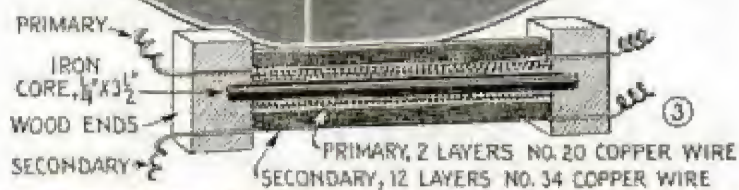
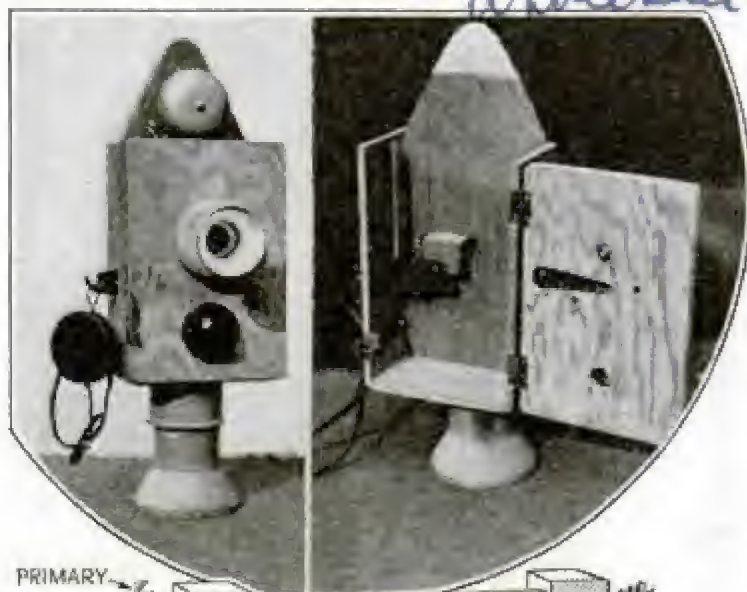
"Sure Sounds Like Bill"

Play Telephone for the Junior Electrician

"HELLO! Bill. Your voice comes in as clear as a 'bell.' You say mine is a little weak? Wait a minute and I'll make a few adjustments. Hello! Now how does it sound? Fine, I had a poor battery connection." Imagine the thrill of a two-way conversation with your friend after you have installed a couple of these phones. They operate on the same principle as the standard instrument, with receiver, transmitter, signal bell, push button, receiver hook or switch lever and induction coil. Without the last, a fairly satisfactory instrument can be made, but as the coil makes the transmission of voice so much more clear it is well worth while to include it. Over-all dimensions of this neat phone are given in Fig. 2. Before starting construction, study the assembly drawing given in Fig. 1. Start with the box. Use $\frac{3}{4}$ -in. material for the back and on this build the cabinet of $\frac{1}{4}$ -in. plywood. The location of various parts on the inside depends upon the equipment selected. It is well to install the bell first, then locate the wood block "A" just under it and about $1\frac{1}{4}$ in. from the left side.

Next make the receiver hook "B" from





a strip of fairly heavy sheet brass. From the same material, cut three contact strips, "C," "D" and "E," and locate them so that when the hook is up it will contact "C" and "D," and when the receiver is on the hook the latter will contact with "E." A light, coil tension spring, "F," keeps the hook up against "C" and "D" when the receiver is in use. Bend a spring latch, "G," from another strip of brass and install as shown. The cover of the box is

made of $\frac{3}{8}$ -in. plywood and carries the transmitter and push button. However, you may find it less complicated to install the push button on the left side of the box, particularly if you are not familiar with intricate wiring jobs. Now comes the installation of the transmitter. This is made up of a transmitter button and a diaphragm. The buttons can be purchased from radio or electrical supply houses. In principle, the button is a shallow cup containing carbon granules between two carbon disks. Vibrations of the diaphragm, caused by sound, actuate one of the carbon disks, which exerts varying pressure on the granulated carbon. Greater pressure gives less electrical resistance and hence stronger current, and vice versa, thus causing a duplicate variation of the diaphragm vibrations of the receiver at the other end of the line. A cross section of the transmitter assembly is shown in detail in Fig. 4. Note that there is a hub on the button which is set in a hole drilled in the cabinet door. This should be a snug fit so that the button is held rigidly. A spring-brass fork is bolted to the plywood door in such a manner that it exerts a slight outward pressure on the small knob, thus holding it against the diaphragm. Some transmitter buttons are equipped with a nut in place of the rounded knob. In that case, drill a hole in the center of the diaphragm, insert the screw and put the nut back again. Such assembly requires an electrical connection on the edge of the diaphragm, but in the original, the spring fork completes the electrical circuit. If a standard diaphragm such as used in a telephone transmitter is not available, you can cut one from a photographers' thin ferrotype plate. Care should be taken not to dent it, for efficiency is impaired if it is not perfectly flat. It should be $2\frac{1}{2}$ in. in diameter. Lacquer should be scraped away at the connections if the diaphragm is used to com-

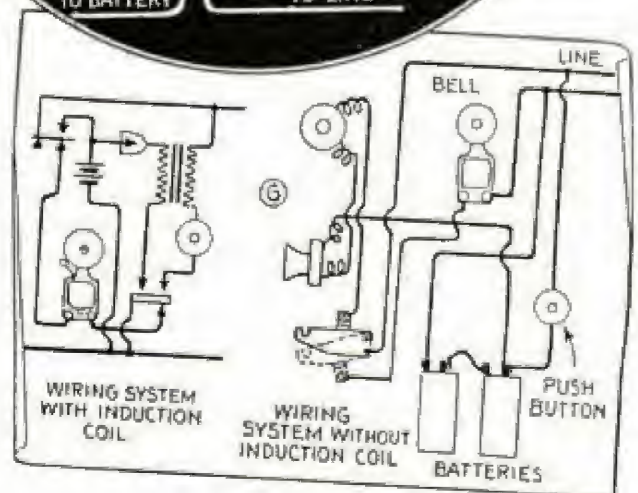
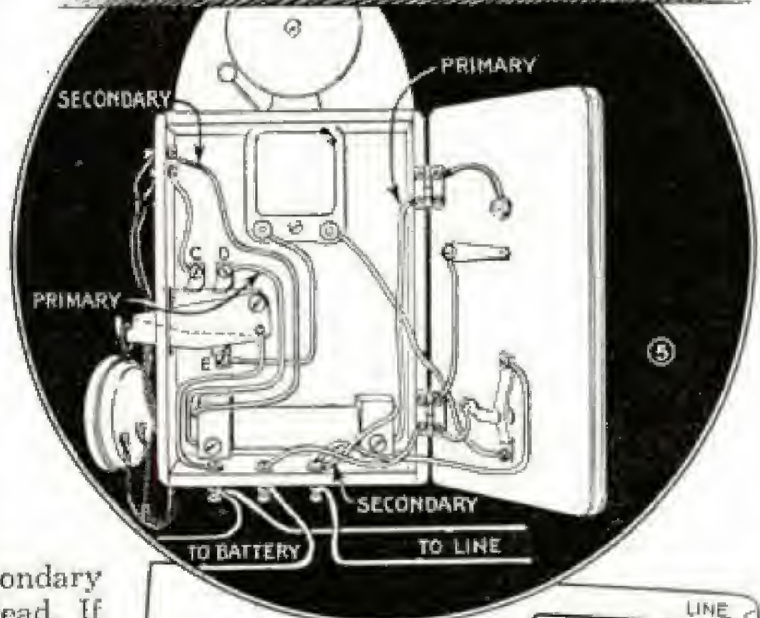
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plete the electrical circuit instead of a spring fork. The diaphragm is held between a wooden ring "M" and a cover disk "N." Note that the thickness of "M" should be slightly less than the height of the knob, so that they will always be in contact. In Fig. 4 is shown the method of turning the cover disk "N" on a lathe faceplate. White pine is recommended because this soft wood is close-grained and not likely to split. By drilling a small pilot hole in the wood when first put on the lathe, it is possible to center the job properly when it is turned over for turning the other side. The hole in the cover disk "N" should correspond to the small end of the mouthpiece used.

As stated before, an induction coil will greatly improve the efficiency of the instrument, and this will require a three-point switch. In the original job, a neat push button was installed just below the transmitter on the door of the box, and the contacts arranged as shown, but it may be found easier to build up a button switch on the side of the box. The importance of an induction coil has been noted, and if you are able to purchase a pair from an electrical supply house, by all means do so as it is a considerable job to wind one neatly. The primary coils are not so hard, but the fine wire of the secondary is like trying to wind a spool of thread. If you are obliged to do the job, however, insert the ends of a bundle of stovepipe wire, $\frac{1}{4}$ by $3\frac{1}{2}$ in., in blocks of wood, 1 in. square, as in Fig. 3. Wrap a sheet of paper around about four times and give it a coat of shellac. When dry, start winding the primary coil, leaving one end project through a hole in the wood block. This coil should be two layers of No. 20 s.c.c. copper wire, with a sheet of paper around each layer, and shellacked. The secondary is No. 34 silk-covered wire and is wound just like the primary except that it has twelve layers. Ends of the wires should be drawn through holes in the blocks, as shown. Cover the finished coil with two or three wrappings of paper and shellac to protect the wires.

Wiring plans are shown in detail in Figs. 5 and 6. Use insulated wire cable



with all connections soldered. Some of the connections to transmitter and push button on the door can be soldered to the hinges, as shown.

Enamelled tile may be cleaned with a cloth dampened with kerosene.



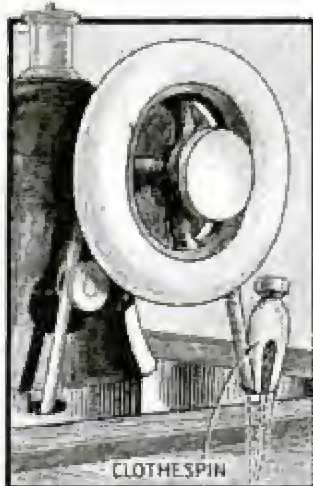
Time-Saving Tool for Removing Old Floors without Splitting the Boards

Tool for Removing Floor Boards with Minimum Damage

Two pieces of heavy flat iron bent to the shape shown and bolted to a stout oak handle make an ideal tool to take up flooring with minimum damage. After taking up a couple of the boards at one side of the floor, the lower end of the tool is placed so that it straddles a joist and is then used as a pry as shown.—True Parker, Homer, Ga.

Belt Wedge Prevents Accidents with Sewing Machine

Small children often have their fingers injured by playing with the treadle and drive wheel of a sewing machine. If a clothespin is tapered at the end to wedge in the belt hole of the machine table, it will serve as a brake, by pressing the belt against the side of the hole, so that the treadle or wheel cannot be operated by the child.



"Cellophane" Ribbon Used as Photo Corners

Short pieces of Cellophane ribbon, which can be had in many colors and combinations, make suitable corners for mounting snapshots in albums. Place each piece over one corner of the photograph, and bend the surplus under the back. Fasten the corners in the album with glue, paste or cement. The snapshots can be removed by raising them up in the center.

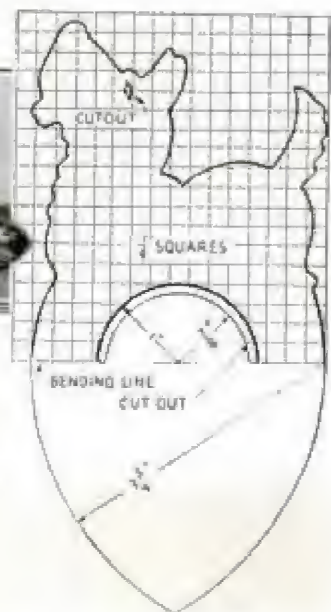


"Scotty" Book Ends Make Ideal Gifts

These book ends, which are sawed easily from pieces of fairly heavy sheet brass or copper, are especially attractive for gifts or prizes at card parties. Make a full-size pattern on cardboard from the squared drawing and cut it out with a sharp knife. Then transfer the design to the metal with a scribe or other sharp object such as a large darning needle. After cutting to shape, smooth the edges

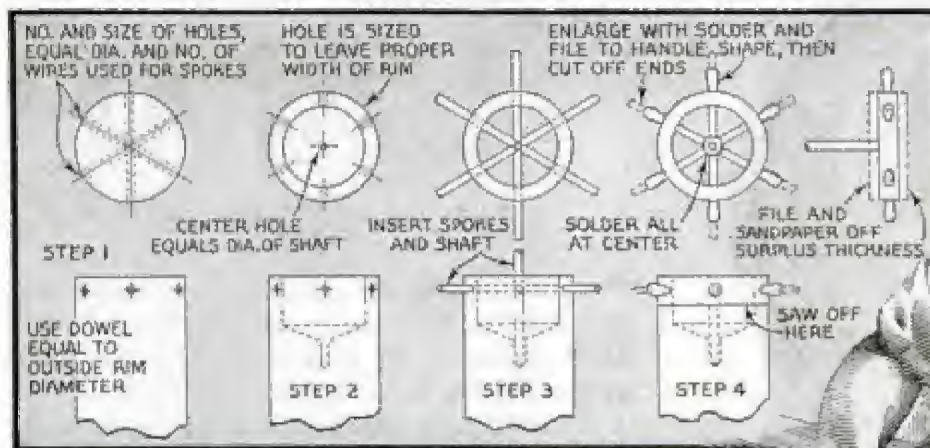


These Attractive Book Ends, Which Are Cut from Brass or Copper, Make Ideal Prizes for Card Parties

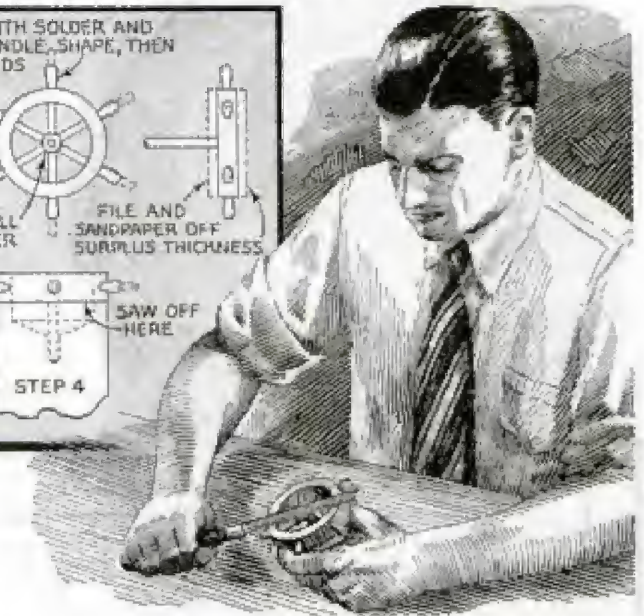


of the metal with a file and emery paper. For final finish, the metal may be buffed and coated with clear metal lacquer or you can use colored enamel.

Steering Wheels for Models Are Made Easily



You can make realistic steering wheels for models by using simple hand tools. First get a dowel of a size equal to the diameter desired for the finished wheel. Then drill holes, equally spaced, near the end for the spokes as in Step 1. Now, drill a small hole in the end of the dowel for the wheel shaft, after which a larger drill is used to remove excess stock between the center and the rim of the wheel, Step 2. As indicated in Step 3, the wire spokes and shaft are inserted and soldered together at the center, after which the wheel



is sawed off the end of the dowel as in Step 4. A fine saw is used for this purpose to prevent roughing the rim unnecessarily, thus reducing the work of smoothing the wheel. The ends of the spokes projecting from the rim are enlarged with solder and then shaped with a file to form handles. Sanding and painting complete the job.

Large Fishhooks Used to Suspend Pictures from Molding

In emergencies, fishhooks can be substituted for ordinary picture hangers when suspending frames from moldings and other projections. As the points of the hooks imbed themselves in the upper edge of the frame, they can be used in places where regular hangers would not hold, such as in paneling strips and other projections found in rooms not provided with regular picture molding.

Secret Message on Paper

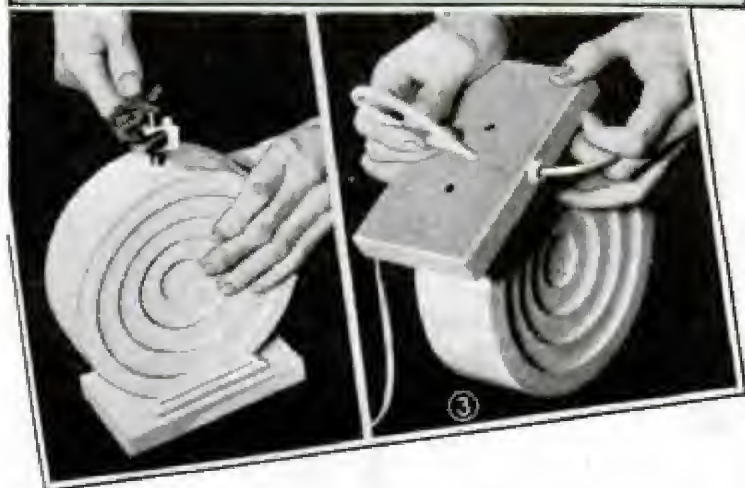
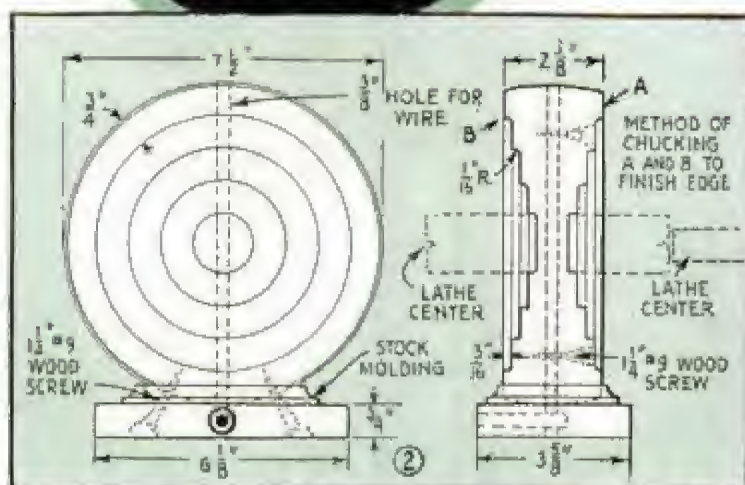
Soak a sheet of white paper in water and lay it on a flat surface such as a piece of glass. Then put a dry sheet over this and write on the latter with a pencil, pressing hard so that the indentation will go through onto the wet sheet. When the writing is completed, remove the dry sheet. After the wet sheet has dried, all traces of writing will disappear, but will reappear when the sheet is again soaked.



Large Fishhooks Are Ideal Hangers for Suspending Picture Frames from Moldings

Modern LAMP

By DANIEL REYNOLDS



SMART, modern lamp bases of elegant design, which will go well with furniture of almost any type, will give a distinctive touch to your living room. For color, you will find that they are especially charming if finished in white, with the lamp shades to match, in accordance with the present fad.

The first base, shown in Figs. 1 to 4 inclusive, is made up of three pieces, two disks turned as indicated and glued together, and then fastened to a rectangular

support. The disks are 7½ in. in diameter and 1¼ in. thick. Each has four ¾-in. steps recessed on one side and a center recess 1½ in. in diameter. After two duplicate disks have been turned, provision is made for accommodating lamp cord through the center. An easy way is to cut a groove diametrically across the flat side of each disk. When the grooves have been cut, the disks are glued and screwed together, taking care that the outside edges are flush and that the grooves line up to form a ¾-in. hole. The job of taking a light finishing cut, after the glue has dried thoroughly, is next. To do this, you can mount the work between two disks turned to fit snugly in the largest recesses, or you can use two plugs, 1½ in. in diameter, as shown in Fig. 4, to fit the center recesses. With the latter arrangement only very light finishing cuts can be taken as it is easy to get the work off center. The assembly is mounted on a wood block ¾ by 3½ by 6½ in. in size. This is done with glue and screws, molding being carefully fitted with glue and brads to hide the joint. The hole for the wire is then continued through the base

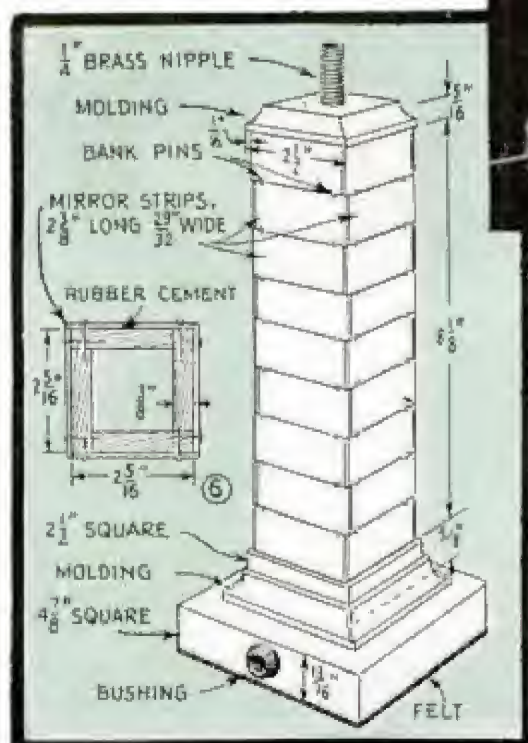
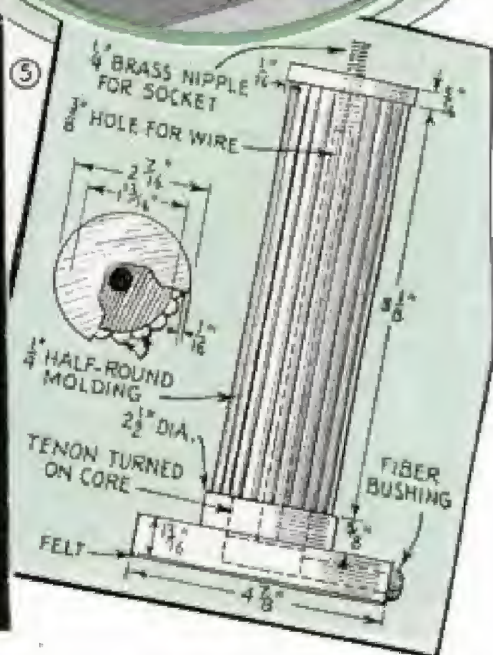
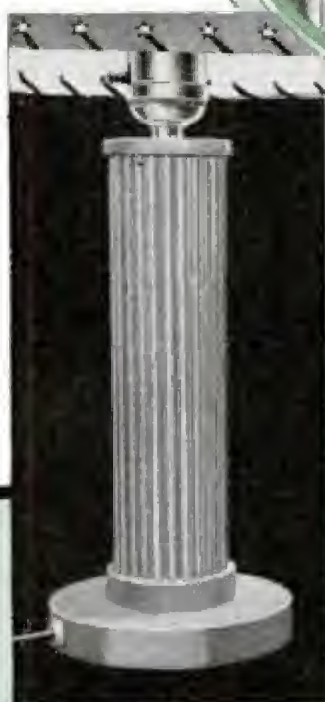
and out through the side, where a lamp-cord bushing prevents any tendency of the rough edges of the hole to chafe the cord insulation. A careful sanding followed by a coat of flat white paint prepares the base for the final finish. As this is one of the most important operations, it should be done carefully. A good grade of white enamel, either glossy or egg-shell finish, may be used. Or, if you prefer a very light gray shade instead of pure white, add a little black enamel, a drop at a time, until

BASES

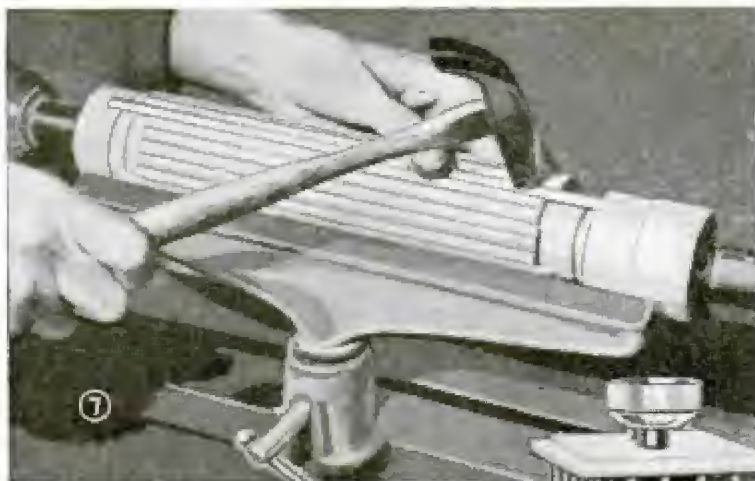
you can make

the desired shade is obtained. The color should not be a decided gray, but should be just a shade off white. This is brushed on and, when dry, it is rubbed down to get a finish that is free from brush marks, using powdered pumice stone and water, and then rottenstone and oil. A piece of felt is used for rubbing. Special care should be taken to avoid cutting the paint film at the edges.

The second type of base is shown in Fig. 5. It has a reeded standard, strips of $\frac{1}{4}$ -in. half-round molding being glued and bradded lengthwise on the surface as shown. If you have the proper equipment, the reeding may be cut directly into the standard. The core is turned first, a short tenon being left on one



end to facilitate assembly to the base. Before removing the work from the lathe, the molding strips are glued and bradded to the outside of the core as shown in Fig. 7, after which the waste stock at the ends is cut off. The lathe should be run at high speed for cutting off the ends and a light cut should be taken. The base is turned next, to the dimensions given in the drawing. This work is entirely a faceplate job. Next, the cap for the top of the standard is turned, after which the parts of the base are assembled. When the glue has set, any surplus is carefully trimmed away and the entire piece sanded. If there are any places to be filled with



plastic filler, this should be done now. The hole for the cord is drilled through the center. The wire enters at the side of the base, and a bushing is screwed in place before painting.

The third base, shown in Figs. 6 and 8, is intended for a dressing table. Its mirrored sides reflect light and make it very attractive. The base and standard are detailed in Fig. 6. The square, hollow standard is built up and is mounted on a base in a manner similar to that of the other lamps. When assembled, the base is carefully sanded and the mirror strips are applied. These strips may run vertically or horizontally, and may be held in place with rubber cement and bank pins. If you do not desire the use of pins, press the mirrors firmly into a layer of glass or iron cement, previously applied to the standard. The mirror and reeded bases should have a push-through socket. Avoid pull-chain sockets as a small lamp is not heavy enough to remain upright.

After a $\frac{1}{4}$ -in. brass nipple has been screwed into the hole at the top of the finished lamp base, you are ready to do the wiring. A horizontal hole in the bottom member breaks into the vertical hole through the center. Fig. 3 shows how the lamp cord is first slipped through the hole in the bottom member, is pulled out under the base and is then pushed through the vertical hole. After making the connections to the socket, turn the latter in counter-clockwise direction a number of times;

then screw it on the nipple the same number of turns, after which it is locked on the nipple. This method prevents the cord from being twisted inside the standard, which tends to pull the wire away from the connections in the socket, possibly causing a short circuit. After the wiring has been completed, the underside of the lamp base is covered with felt in order to avoid marring finished surfaces on which the lamp is to be set. It is an easy matter to glue the felt on and, after the glue has dried, to cut away the surplus with a sharp knife as shown in Fig. 9.

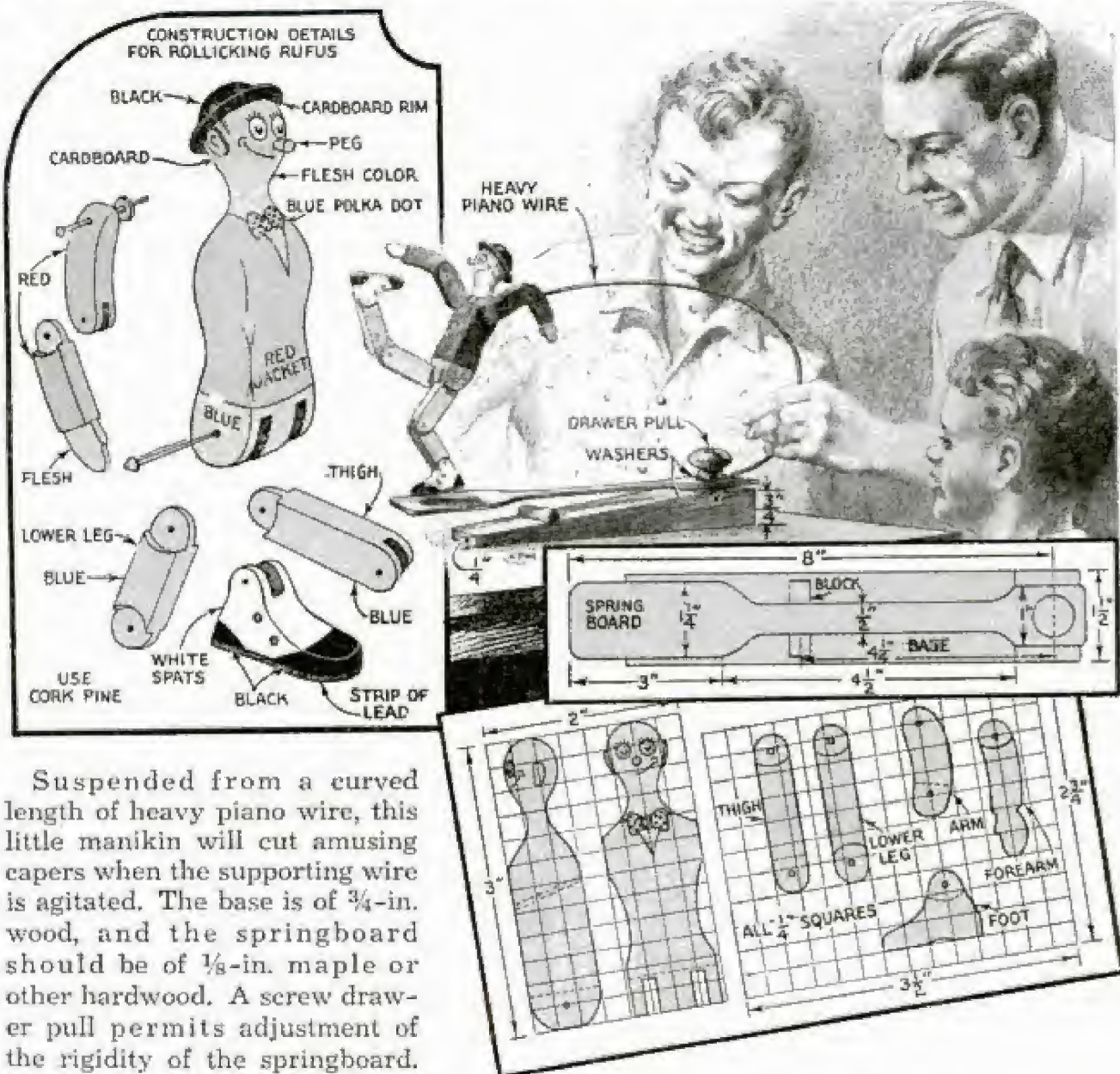
Shades for these lamps may be made or purchased. Attractive shades can be made by stretching silk, parchment or colored Cellophane over wire frames. These are easy to make if some method is improvised to roll the wire rims



to the proper shape, after which the cross and support wires are soldered to them. Or, the frames can be purchased cheaply in most large department stores.

⚠ Coal tar stains paint, and therefore it is necessary to insulate it with shellac; remove as much of the tar as possible by scraping and apply a thin coat of shellac. Paint will adhere to the shellac, and the stain will not penetrate.

"Rollicking Rufus" Will Dance Amusing Jigs



Suspended from a curved length of heavy piano wire, this little manikin will cut amusing capers when the supporting wire is agitated. The base is of $\frac{3}{4}$ -in. wood, and the springboard should be of $\frac{1}{8}$ -in. maple or other hardwood. A screw drawer pull permits adjustment of the rigidity of the springboard. Washers should be put above and below the board. The figure is carved from soft pine. Sizes of the legs and arms, which are pivoted loosely to the body, are given in the squared drawing. Note that a thin strip of lead is fastened to the underside of the feet to bring them down with a "snap" on the springboard. A good paint job makes the figure look quite realistic. Two coats are advisable, one in flat white or gray paint, and the second in the finished color. Flesh tint for the face and hands can be made by mixing a very small amount of red and orange with white. The base should be gray or black and the springboard should be varnished a natural color. When the paint is dry, sandpaper the joints smooth where they rub together and wax them to reduce friction.

Vacuum-Clean Your Hot-Air Furnace Pipes

Drapes, decorations and other things in the hot-air heated home stay clean longer if the air pipes of the furnace are cleaned at least once a year with a vacuum cleaner. Using the long hose and narrow nozzle, the hot-air pipes can be cleaned quite a distance down from each register. In a similar way, the cold-air intake can be cleaned. Of course, a thorough job requires getting into the furnace end of the pipes. If insulation on the pipes does not make this too difficult, it is worth while. However, most of the dirt will be found rather near to the registers where it is easy to reach.—C. E. Packer, Chicago.



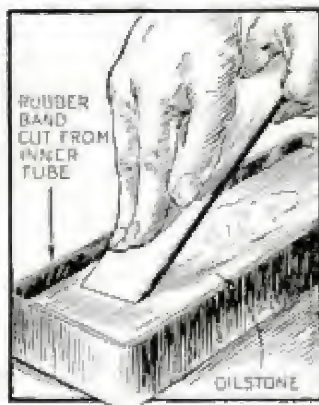
Paper Plate Slipped over Socket to Serve as an Emergency Reflector for a Photo-Flood Lamp

Paper Plate Serves as Reflector for Photo-Flood Lamp

In an emergency, a paper plate will serve nicely as a reflector for photo-flood lamps. The plate is cut from one edge to the center, after which the edges of the cut are overlapped and glued to give the plate a modified cone shape. Cutting a hole at the apex of the cone to take a lamp socket, completes the job.

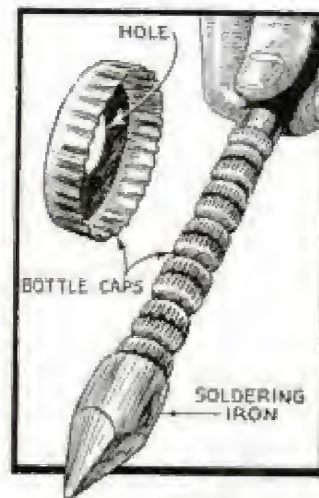
Rubber Band around Oilstone Prevents Breakage

By cutting a wide rubber band from an old inner tube, and snapping this around an oilstone as shown, the latter will be protected from breakage if accidentally dropped against other tools. Also, the portion of the rubber projecting above the surface of the stone will serve to retain oil or water used in sharpening tools.



Keeping Handle of Soldering Iron Cool with Bottle Caps

By slipping a number of bottle caps on the shank of a soldering iron, so much heat will be radiated that the handle will be kept comfortably cool and will not be charred. The caps should be drilled for a snug fit on the shank and they should be placed in pairs with their backs together as shown in the drawing.—A. H. Waychoff, Tempe, Ariz.



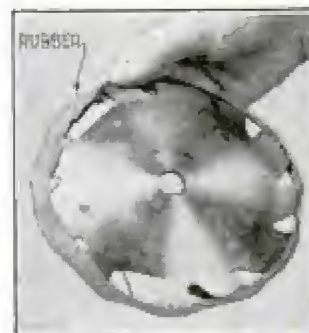
Lathe Turnings of Small Diameter Smoothed with a Plane

As an aid to prevent long, small-diameter lathe turnings from "whipping" when shaping the center section of the piece, a small block plane can be used as shown. The plane blade should be razor sharp and the heel of the plane should be held on the tool rest in order to cut the rotating stock at a slight angle.—Ray J. Marran, Kansas City, Mo.



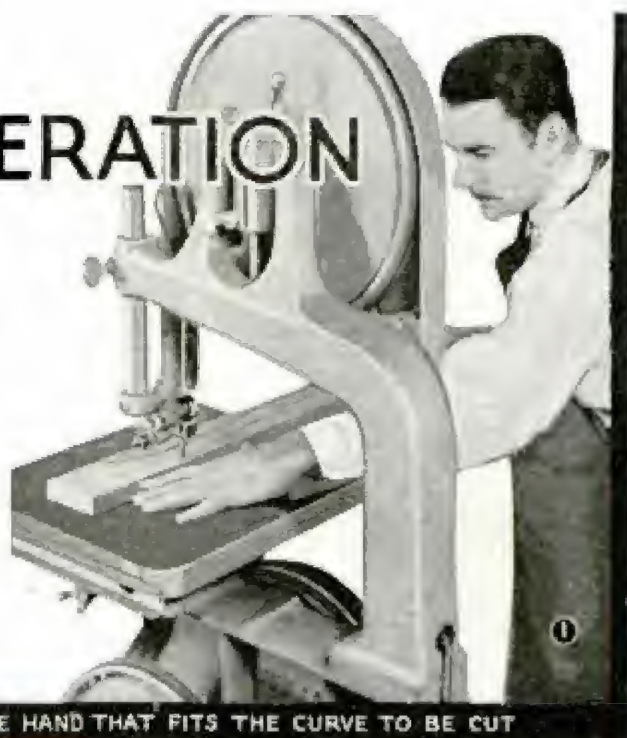
Piece of Inner Tube Protects Teeth of Circular Saw

When circular-saw or dado-cutter blades are laid aside for some time, they should be protected by covering the teeth in order to prevent their dulling or rusting. A good way to do this is to stretch a wide rubber band over the teeth. A band of the right size for this purpose can be cut from an old inner tube.

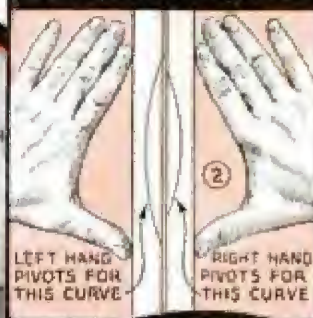


Tricks of BAND-SAW OPERATION

ONE of the most important considerations in band-saw work is side pressure. There is always a certain amount of play in a band-saw blade, which if unguided, weaves from one side of the saw kerf to the other. This is overcome by exerting a very light side pressure against the work as shown in Figs. 1 and 2. Side pressure can be applied effectively when making ripping cuts. In this case, the pivot point is best restricted to a single contact, such as the knuckle of the thumb or one



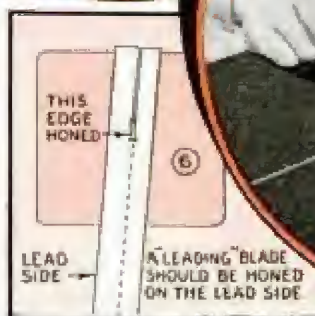
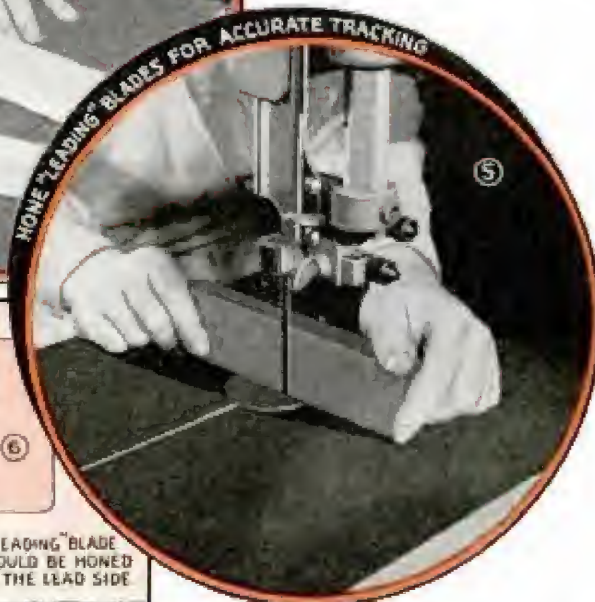
PIVOT WITH THE HAND THAT FITS THE CURVE TO BE CUT



that is not parallel with the table. The remedy is quite simple—a stone applied lightly to the leading edge, as in Fig. 6, removes the burr and permits straight tracking. A slight touch is all that is necessary to remove the burr. When a band saw is fitted with a ripping fence, this honing should be done as the fixed fence is practically useless if the blade has the slightest tendency to “lead” to one side.

or two fingers, Fig. 3. This pivot should be directly in line with the teeth of the blade.

Few workers make proper use of turning holes, Fig. 4. These should always be the initial job in cutting an intricate pattern. Square turning holes will assure square corners in the work while round holes are useful in shaping small curves to the exact line. Almost every band-saw blade will show a very fine wire edge as in Fig. 6. The result of this is a tendency for the blade to cut a line



Cleaning Sink Drains



Old Piece of Chain Used to Clean Out Drain Pipe, Which Ran Horizontally under the Floor

In my home the drain pipe from the sink runs horizontally underneath the floor to the soil pipe. Due to this level position of the pipe, it filled with sediment so that water would hardly pass through it. As the usual methods of cleaning sink drains did not work effectively on this installation and I did not wish to tear up part of the floor, the following method was used: A small piece of cork was fastened to one end of a stout thread, the screen in the sink removed, and the cork placed in the mouth of the drain. The sink was then filled with water, which carried the cork and thread beyond the clean-out plug in the trap under the floor, after which the water was shut off and the plug removed. After "fishing" around a bit, I found the thread. A piece of heavy cord was tied to the end of this and carefully pulled back through the pipe to the sink. Then a piece of $\frac{1}{4}$ -in. rope was tied to the cord and pulled back to the trap, after which a 12-in. length of pump chain was tied to the rope. This was slowly pulled back and forth through the drain to clear it.—E. O. Blanchard, Wellington, Ohio.

Kindling Sticks to Start Fires in Stoves and Furnaces

To expedite starting a fire, the following safe product may be cast into molds, made by gouging channels in blocks of wood, and stored ready for use: Carefully melt

ordinary rosin or pitch and add an equal weight of fine sawdust. The resinous mixture should be stirred to an even mass and then poured into the molds while hot. If the sawdust is coarse, the amount may be increased without sacrificing ease of lighting. The kindling takes fire readily and produces a large flame.

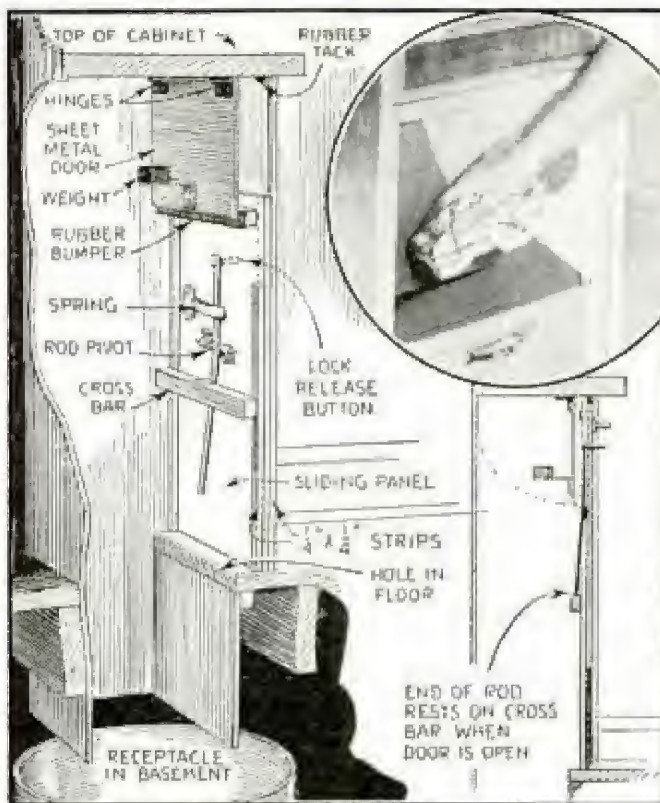
Soap-Bubble Fountain Makes Beautiful Night Display

Hundreds of soap bubbles floating upward into the night air, where they are picked up by beams from hidden floodlights, make a colorful display when this soap-bubble fountain is in action. The secret of the fountain is city gas flowing into cans or pails which contain a saturated solution of castile soap and water. To this is added glycerine equal to 5 per cent of the volume. The containers are assembled in a group, and the gas is led into them with an ordinary garden hose, the flow of gas being controlled by a valve. The floodlights are covered with colored Cellophane and are arranged to direct light on the bubbles as they rise from the cans.



City Gas Flowing into Soapy Solution Makes Bubbles on Which Colored Lights Shine as They Rise

Trash Chute to Basement Housed in Cabinet



The problem of disposing of sweepings and waste paper in the home is solved by a built-in cabinet, which conceals a chute through the floor to a trash box in the basement. The cabinet is built wherever convenient, and has two doors in the front as shown. The upper one is hinged to the underside of the cabinet top, and the lower one is arranged to slide up and down.

The sliding door is provided with a latch to hold it open. This is a length of brass tubing or iron rod pivoted to the back of the panel as shown. The tube is curved slightly so that pressure exerted by a flat spring, causes the lower end to slip over a crossbar to hold the door open when it is raised. The latch is released by a short handle which projects through the door.

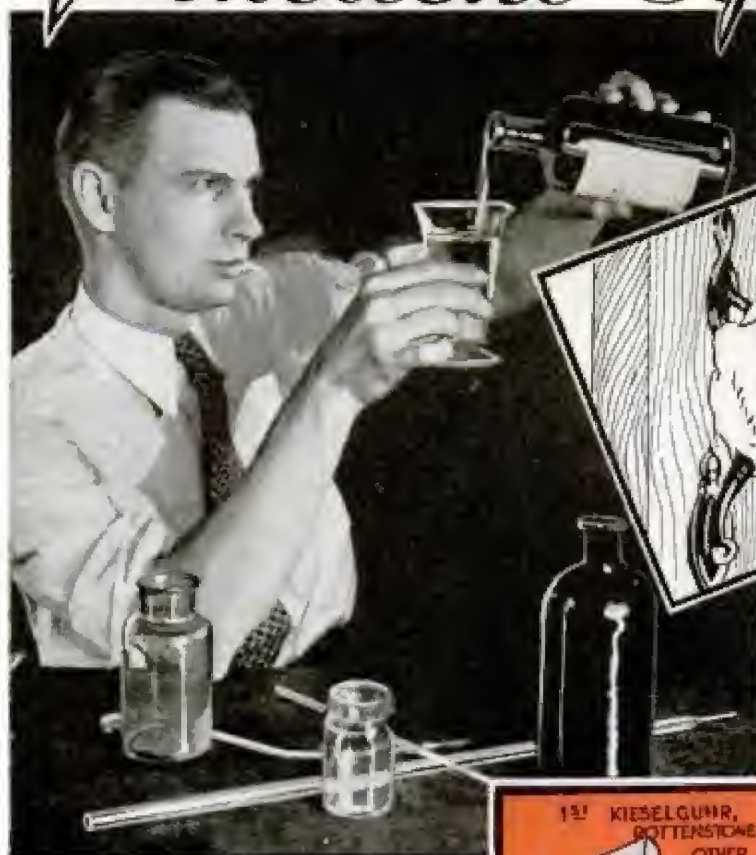
Workbench Seat Swings Out of Way When Not in Use

If you find a regular stool inconvenient at your workbench, try this swinging seat, which can be pushed under the bench out of the way when not in use. Pipe and fittings are used in the construction and are assembled as shown, floor flanges being used as pivots on the floor and on the underside of the bench top. These flanges should be slightly larger than the pipe so that the ends of the latter fit loosely in them.

☛ To paint a monogram or other device on leather do not use oil paint, which will spread, but mix some coach color, which is ground in japan or turpentine, and thin it with turpentine, adding a little carriage-finishing varnish as a binder.



Practical Experiments

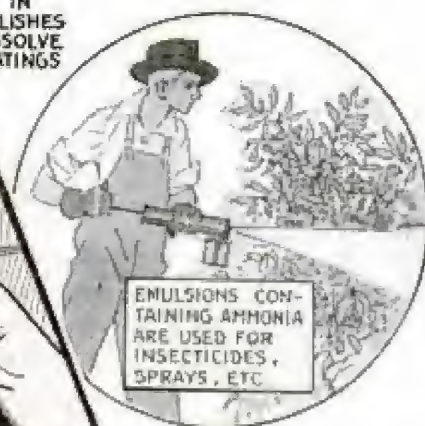


Pouring Ammonia Above Eye Level Will Allow the Fumes to Rise Where They Will Not Cause Irritation

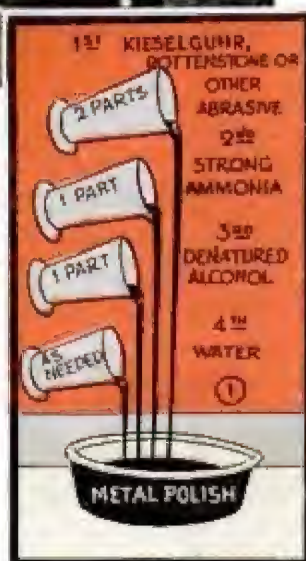
IF YOU want to know how everyday household necessities such as furniture polish and wax, insecticides, cleaning preparations, etc., are made, much can be learned by experimenting with a bottle of ordinary ammonia.

Strong ammonia, as sold at the drug store, should be used in all of the work described here. Ordinary household ammonia is too weak for most purposes, and besides it contains other chemicals added to make it more effective for cleaning purposes. The evil-smelling fumes of ammonia are somewhat irritating and it should not be smelled to determine the strength of the solution. While handling ammonia, remember that ammonia gas is lighter than air; therefore it is a good idea to hold the bottle above the level of the eyes while pouring. If this is done, the fumes will rise and cause little or no inconvenience.

AMMONIA IN METAL POLISHES HELPS DISSOLVE OXIDE COATINGS



Metal polishes for use on copper, brass, or nickel frequently contain a small amount of ammonia because of its power to dissolve the oxide or rust coatings that form on their surfaces. To demonstrate this property, you may place a small amount of black copper oxide, which is the substance which forms on the surface of copper after it has been exposed to the weather, in the bottom of a test tube and cover it with ammonia solution about 1 in. deep. After shaking the tube, it should be noted that the colorless ammonia has changed to an intense azure blue color. This shows that the black copper oxide has been dissolved. For the experiment, the black oxide of copper may



be obtained at the drug store if none is available from a weather-blackened copper utensil.

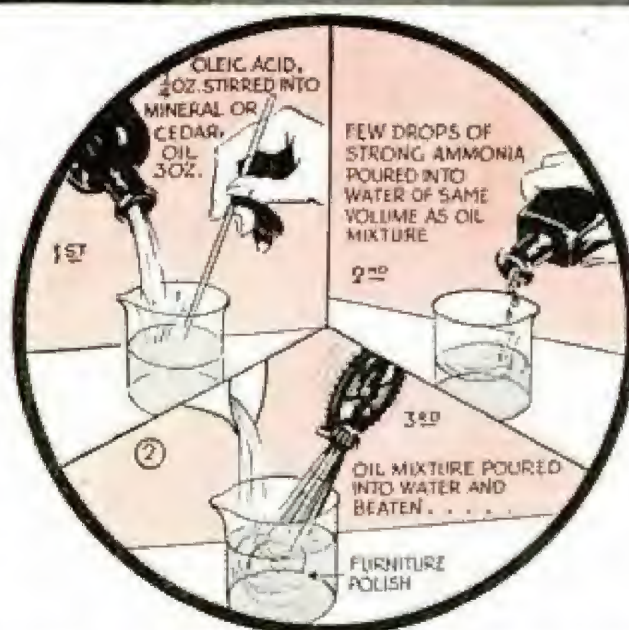
A good metal polish in which advantage is taken of this property of ammonia, is made by mixing together kieselguhr, 2 parts, strong ammonia solution, 1 part, denatured alcohol, 1 part and sufficient water to make a thick creamy polish. See Fig. 1. If the polish is stored in a bottle or can, it should be shaken before using. To use the polish, pour a small amount of it on a soft cloth and rub the metal briskly.

with AMMONIA



After cleaning, the metal should be rubbed with an oily rag to prevent tarnishing. There are many other materials that may be used in making metal polishes of this type. Jewelers' rouge, rottenstone, pumice or whiting may be substituted for the kieselguhr to produce a polish having just the right amount of "bite" for the metal to be polished. In making polishes, it is well to keep in mind that experience is the best teacher. Therefore, the amateur chemist should not hesitate to try new combinations of constituents, which may produce a superior product.

The proverbial fact that under ordinary conditions oil and water will not mix, may be contradicted by a simple experiment. To mineral oil, about 3 oz., or any other lightweight oil, add oleic acid, about $\frac{1}{4}$ oz., and stir. This may be obtained at any drug store. It is the same substance as is sold as "red oil." Into a larger vessel pour an amount of water about equal in volume to the oil mixture. Into the water pour a few drops of strong ammonia solution. To produce an even mixture of the oil and water, pour the oil mixture into the water while stirring vigorously or using an egg beater. Almost instantly a thick white creamy paste will be formed. This should be stirred until it is perfectly even and smooth. The process of doing this is illustrated in Fig. 2. If you will feel the side of the container during the mixing, you will find that it has become slightly warm due



Steps in Preparing an Emulsion Furniture Polish and Cleaner; Oleic Acid and Ammonia Combine Chemically to Form a Soap

to the chemical reaction which has taken place. Emulsions, as thick creamy mixtures of this type are called, are used as furniture polishes, insecticides, orchard sprays, disinfectants, automobile polishes, hand cleaners and for hundreds of other preparations where the product must have both the properties of oil and of water. Of course, different kinds of oils or melted waxes are used in the manufacture of the different preparations. The more water



Ammonia Is Used in Refrigeration; This Experiment Shows How Air Blown through Ammonia Will Freeze a Drop of Water between a Thin Beaker and a Block of Wood, so Both Can Be Lifted Together



that is used in making the emulsion, the thinner will be the mixture. If just the correct amount of ammonia is added to the water the finished product will have no odor of this chemical. The exact amount can be found easily by experiment and will be found to vary depending upon the strength of the ammonia used. Similarly, the amount of oleic acid added to the oil is best determined by practice in making up any particular mixture. If the emulsion made as above is diluted with water and stirred, a thin milky solution will form because it is soluble in water. If mineral oil or cedar oil is used in making the emulsion as above described the product will be a good oil furniture polish. It is applied by rubbing on with a moist cloth dampened with the cream. This polish will also act as a cleaner at the same time it polishes because the ammonia and oleic acid combine chemically to form a soap. If a stronger cleaner is wanted the amount

of oleic acid and ammonia may be increased as desired.

To make a wax polish, melt beeswax, carnauba wax, and paraffin together in proportions to suit, and add the oleic acid to the molten mixture. Care should be taken not to overheat the waxes. They should just be melted. The water to which the ammonia is added should be heated to almost the boiling point and the hot molten waxes poured in while stirring. In making waxes, about three times as much water as wax is generally used. However, this can be varied to suit, and here again the beginner should remember that frequently amateur chemists, while experimenting, discover little points which are of extreme importance in making

preparations of this type. Many large, profitable businesses depend entirely upon the merit of formulas worked out by such simple experimental methods.

A clear varnish, which may be diluted with water but dries waterproof, may be made by using linseed oil and oleic acid as the oil part of an emulsion, and proceeding as already explained.

As in the other formulas, the experimenter should try out small amounts until he has found a mixture that will give the results desired. In following these methods remember that if the waxes or oils used to make emulsions have to be melted, the water-and-ammonia mixture must also be heated before it is mixed with the hot oils or waxes. If a preparation is wanted for cleaning purposes, the amounts of ammonia and oleic acid should be increased to produce more soap. Also, mild abrasives such as chalk, diatomaceous earth, rottenstone or fine emery may be added if desired.

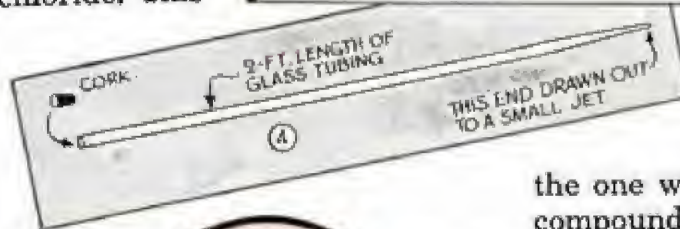
Ammonia is also used in refrigerators. To show how this chemical produces cold, you can set a thin-walled beaker of strong ammonia over a drop of water on a block of wood and blow through the solution with a piece of glass tubing. The tubing should be long and care should be taken not to suck any of the fumes into the

mouth. The long tube will make it possible to stand far enough away from the fumes to prevent their bothering your eyes. After blowing through the solution for a few minutes, the water under the beaker will be frozen solid and the block and beaker may be lifted together as shown in one of the illustrations.

Another very striking method of showing the cooling effects of ammonia is to have some one hold two empty beakers. On the bottom of one of the beakers place about a $\frac{1}{4}$ -in. layer of dry sodium carbonate of the grade used by photographers. Into the other place a similar amount of ammonium nitrate or ammonium chloride. This



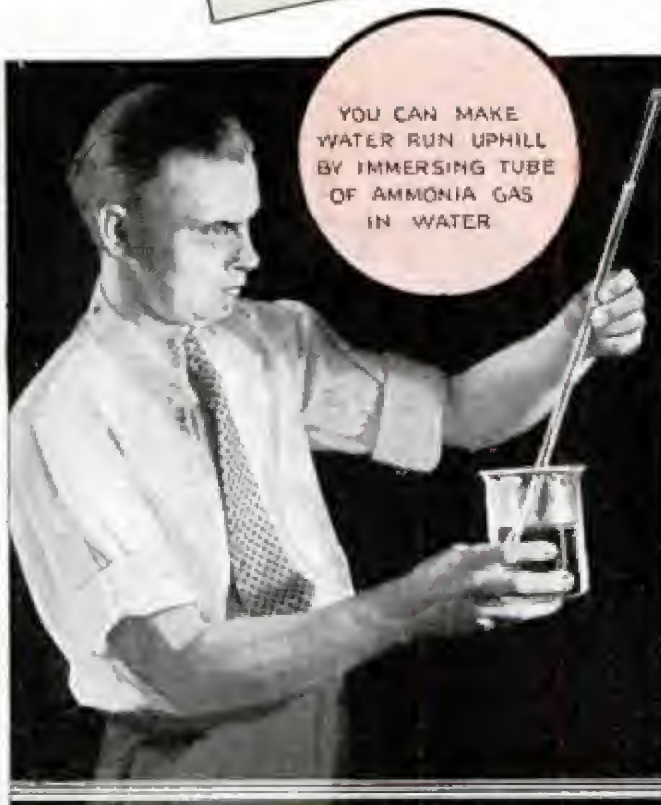
Simple Demonstration of Cooling Effect Caused by Dissolving Ammonium Nitrate Compared to Heating Effect Produced by Dissolving Sodium Carbonate



done, pour water, about 1 oz., into each beaker. The person holding the beakers will very quickly note that

the one which contains the ammonium compound gets very cold and the other very hot as indicated in Fig. 3.

Water running up hill is unusual, but the impossible again can be accomplished with this unusual chemical. Fig. 4 shows a 2-ft. length of glass tubing, one end of which is drawn out to a small jet. When the tube is filled with ammonia gas with its large end corked and the other end immersed under water, the trick of water running up hill will be accomplished. As ammonia gas is colorless not enough of it will escape through the small opening to make its smell noticeable, and therefore the real reason for this apparent defiance to the law of gravity cannot be guessed. When the tube is set in the water the water slowly rises almost to the top of the tube. The ammonia is greedily absorbed by water. Therefore a vacuum is created which sucks the water into the tube. Usually 1 gal. of water can absorb over 700 gal. of ammonia gas.



Wooden Tongs to Handle Hot Clothes Prevent Burned Fingers

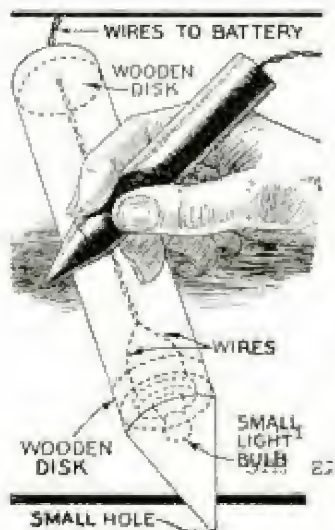


Hardwood Tongs Prevent Burning the Hands When Removing Hot Clothes from Washboiler

For lifting hot clothes from a washboiler, or for feeding them into a wringer, these wooden tongs will save much time and eliminate burned fingers. They are made from a piece of hardwood, which is cut to the shape shown with a scroll saw. A bolt through the tongs at the point indicated will prevent splitting.

Electric Pencil Records Data on Photo Films

With this electric pencil, data are recorded on an undeveloped film without the mess and bother of chemical inks. The recording is done as an actual part of the photo by a tiny light beam that exposes the portion of the film on which the writing is done.

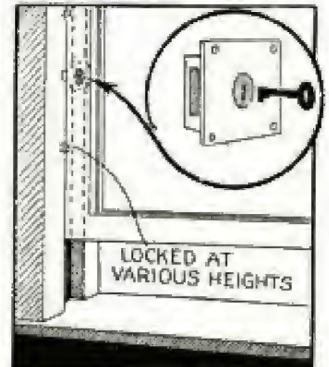


The barrel of the pencil is a $\frac{3}{4}$ by 4-in. tube with wood disks fitted snugly into the ends, one disk carrying a socket with 6-volt lamp, which is wired to a flashlight battery or toy transformer. Over the lamp end of the pencil, a cone

is fitted tightly. This has a small hole at the apex through which light shines to expose the film.—D. J. Egan, Paterson, N. J.

Cabinet Locks Make Windows Burglar Proof

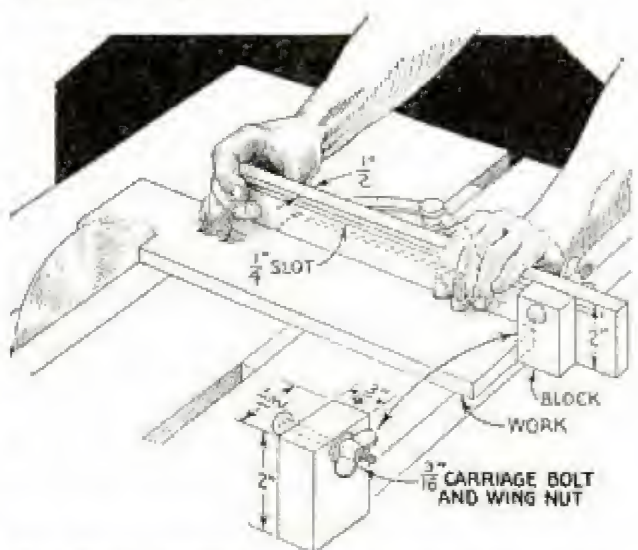
By installing small cabinet locks, of the type shown, in your windows, you can leave them partly raised for ventilation without any fear of a burglar entering through them. These locks can be purchased for ten or fifteen cents each, and one is installed in each sash. Small recesses to take the lock plungers are cut in each window casing,



spacing them according to the heights to which you wish the window raised.—Jas. Gibson, Columbus, Ohio.

Stop Gauge for Your Circular Saw

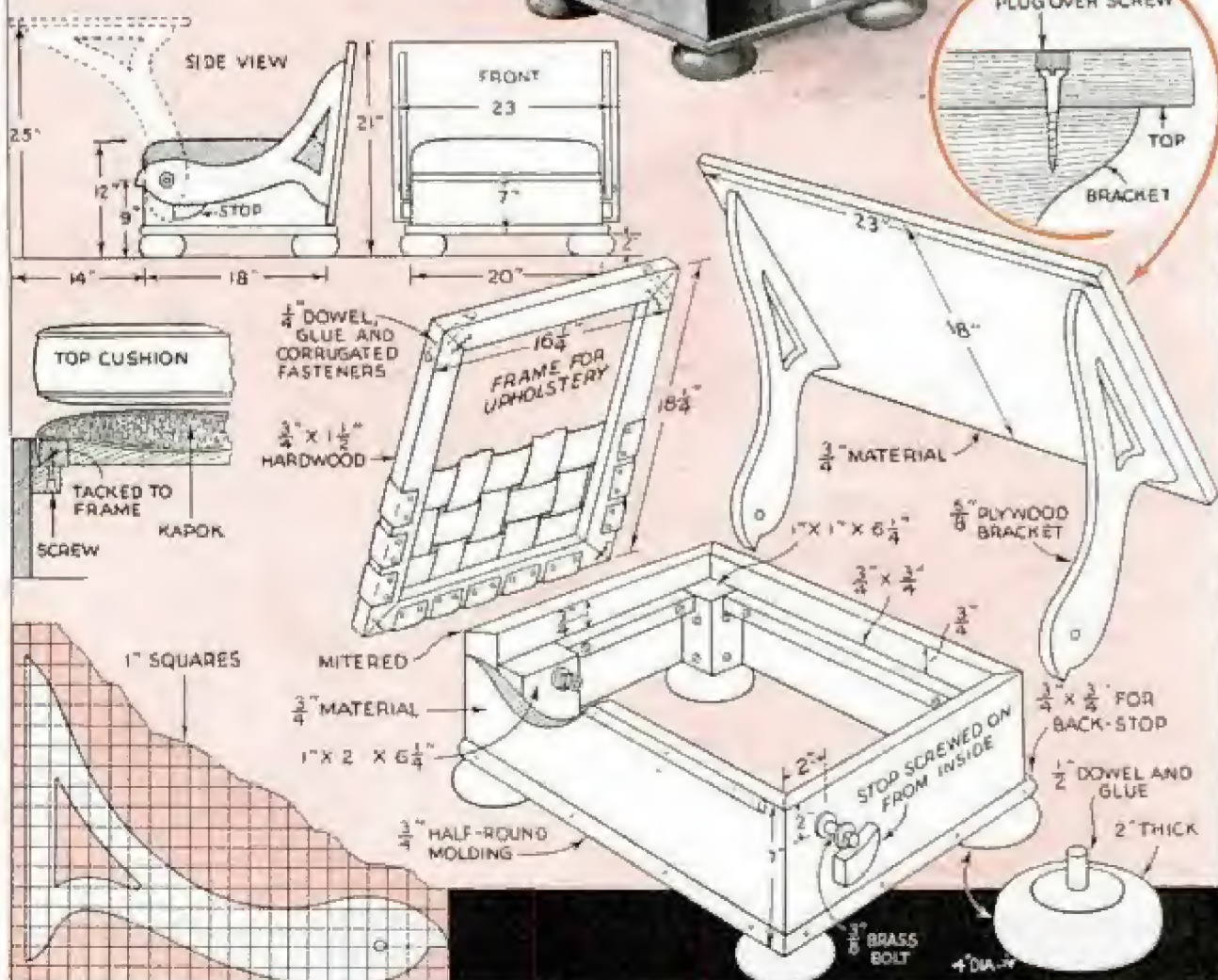
A simple stop gauge for your circular saw is made by cutting a slot in a piece of hardwood along which an adjustable block can be moved. The slot should extend just high enough above the metal gauge to permit turning the wing nut on the bolt by which the stop block is secured. A gauge of this type will be found accurate and it is easily adjusted.



Stop Block on Miter Gauge of Circular Saw Assures Accurate Cutting of Duplicate Work

Folding FOOT TABLE

also serves as CHAIR





Spring Stop That Limits Movement of a Drawer, Yet It Can Be Released to Remove the Drawer

Spring Drawer Stop That Can Be Released in a Moment

Pivoted to the inner side of a drawer as shown, this plywood stop can be held down with the fingers when it is necessary to remove the drawer. Fasten the stop to the side of the drawer so that a portion of it projects above the upper edge. Then bend a piece of piano wire so that there is a small loop at one end and another in the center. The end loop passes around a small screw driven into the lower front corner of the stop, while the center loop encircles a screw that serves as a peg to limit travel of the stop. The other end of the wire presses against the drawer.

☛ Brown stain on teacups can be removed with a solution of salt and vinegar.

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All six blueprints listed above will be sent to you prepaid upon receipt of \$1.00, or separately for 25c each. Also send 12 cents for our booklet "What to Make" which lists hundreds of other blueprints for practical craftsmen. These include plans for home improvement, furniture, novelties, toys, boats, models, outdoor sports, and many other miscellaneous subjects.



12-In. Band Saw—836

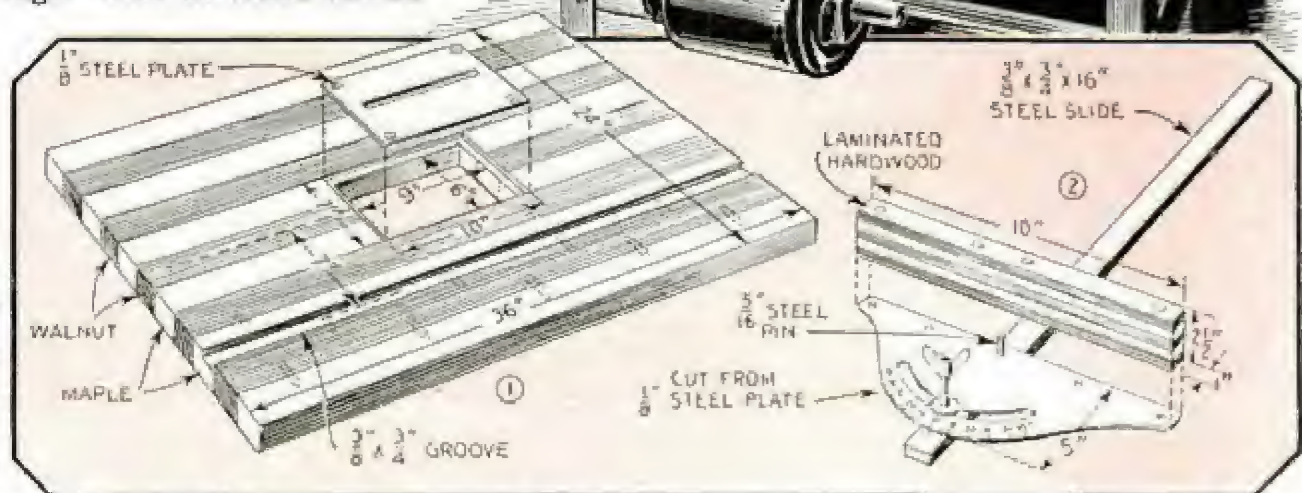
Blueprint Department, Popular Mechanics Magazine, 200 E. Ontario St., Chicago

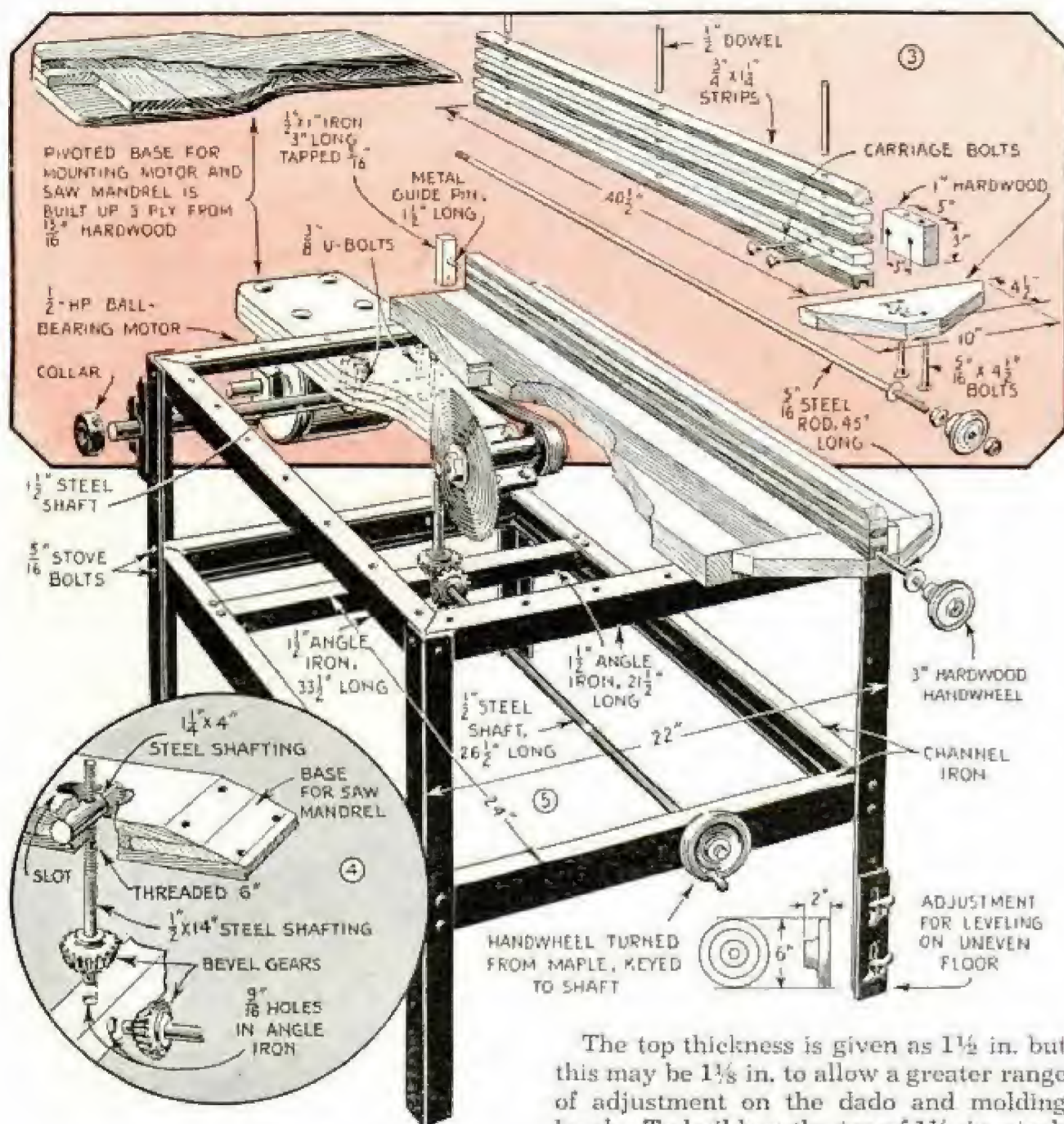
SHOP NOTES

Workshop *P. 910* SAW TABLE *is large and sturdy*

BUILT with a sturdy angle-iron frame and a laminated hardwood top this motor-driven saw gives you ample capacity for crosscutting and ripping wide boards. The large table is stationary. A novel device for raising and lowering the saw makes it possible to cut to any desired depth within the limits of the saw blade.

The four legs are cut from $1\frac{3}{4}$ -in. angle iron, the top rails from $1\frac{1}{2}$ -in. angle iron and the middle stretchers from channel iron, 4 in. wide. Fig. 6 gives you the location of the $\frac{5}{16}$ -in. holes to be drilled in each leg. These holes are in the same position on both faces of the angle. The location of the holes through the ends of the rails and stretchers is laid out from those already drilled in the legs. With all holes drilled





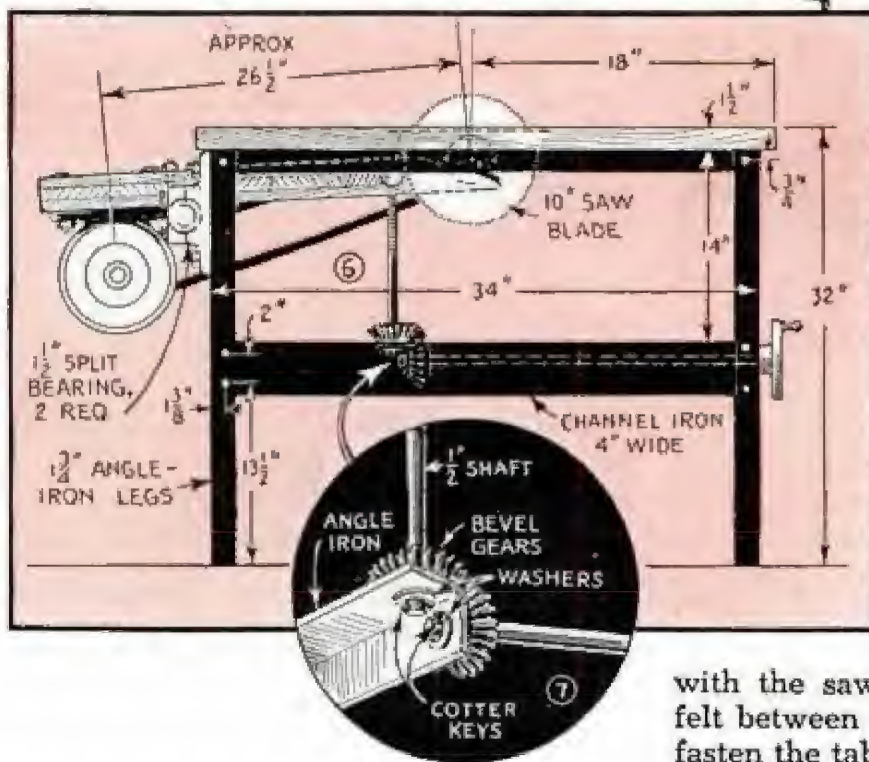
you can set up the frame by joining the legs to the channel-iron stretchers with $\frac{5}{16}$ -in. stove bolts, the nuts drawn down on lock washers. The top rails are mitered at the ends as in Fig. 5. With the frame set up, drill a line of small holes, spaced 8 in. apart, through the top of the upper angle-iron rails to take screws driven into the top. If the machine is to be taken about to the job or operated on an uneven floor, saw one of the front legs about 1 in. short, cut two $\frac{5}{16}$ -in. slots in a piece of $\frac{1}{4}$ by $1\frac{3}{4}$ -in. flat iron and bolt it to the leg as in Fig. 5. This will give you an adjustment to take care of any unevenness in the floor.

The top thickness is given as $1\frac{1}{2}$ in. but this may be $1\frac{3}{8}$ in. to allow a greater range of adjustment on the dado and molding heads. To build up the top of $1\frac{3}{8}$ -in. stock rip six $2\frac{1}{4}$ by 38-in. strips of hard maple and five strips of black walnut the same size. Run a $\frac{3}{8}$ by $\frac{3}{4}$ -in. rabbet on the edge of one of the maple strips. Lay out and drill $\frac{7}{8}$ -in. holes for staggered 2-in. dowels as shown in Fig. 1. The table opening should be wide enough to take the length of the mandrel so that the saw will raise high enough to give the full cutting capacity of the blade. Cut the stock for the table top accordingly and assemble as in Fig. 1 with waterproof casein glue in all joints. Allow ample time to dry before you loosen the clamps. To finish, first plane the table crosswise to even up, then plane lengthwise with the jointer plane and

*Every Mechanic's
Suppl. to 25 1st ed.*

sandpaper on both sides to a uniform thickness. Square up to size, plane all edges at right angles and be sure that the sides and ends are parallel. Apply two coats of white shellac to both sides and finish with wax. A $\frac{1}{8}$ -in. rabbet is cut around the top edge of the opening. In this you fit two $\frac{1}{8}$ -in. steel plates, one slotted for the saw blade, the other with a wider slot for the dado and molding cutter. Fasten with short screws. The $\frac{3}{4}$ -in. groove for the crosscut guide may be located on either side of the saw, or one on each side.

Next you make up the base for the motor and saw mandrel. This is made 3-ply



you are ready for the tilting device shown in Figs. 4, 6 and 7. It is important that the vertical shaft has no end play. Set the table on the frame, aline it

with the saw blade, place strips of thin felt between the table and the frame, and fasten the table in place with screws.

of $\frac{3}{4}$ -in. hardwood. The exact size of the base depends on the type of motor and saw mandrel you use. The forward end of the base is beveled for the mandrel which is usually fastened with bolts or heavy screws. As you will see from Figs. 3 and 6 the base is pivoted on a $1\frac{1}{2}$ -in. steel shaft supported in two split bearings bolted to the back legs. The base is attached to the supporting shaft with $\frac{3}{8}$ -in. U-bolts, or you can use two additional split bearings for this purpose. The motor is bolted in place with a $\frac{1}{2}$ -in. V-belt running over a 2-in. diameter V-pulley on the mandrel and a 5-in. V-pulley on the motor. These pulleys will give proper saw speed with the motor turning 1,750 r.p.m. This done,

Fig. 3 details the ripping fence and Fig. 2 the crosscut guide. Both sides of the fence should be finished true throughout the length. The wood is then sanded smooth, shellacked two coats and waxed. Two $1\frac{1}{2}$ -in. shaft collars are placed tight against the bearings on the shaft supporting the motor base. All bolts, including those on the split bearings, are then drawn tight. The motor and saw-mandrel mounting, as shown in the drawings, is correct for motors that run in anti-clockwise direction as you are facing the pulley. If your motor runs in clockwise direction, it should be turned end for end so that the pulley and belt are on the opposite side, or the belt may be crossed.

Drop-Side Lathe Box Needs No Dustpan



Side of Lathe Scrap Box Drops Down So That Sawdust and Shavings Can Be Swept into It

To save time in hunting up a dustpan, when cleaning up around the lathe, one woodworker designed a lathe scrap box with a drop side. The top edge of this side is beveled to fit snugly against the floor and the scattered sawdust and shavings may be swept quickly into the container.

"Paddle-Wheel" Sign Made from Junk Parts

Here is an unusual revolving display sign that attracts the eye by its odd move-

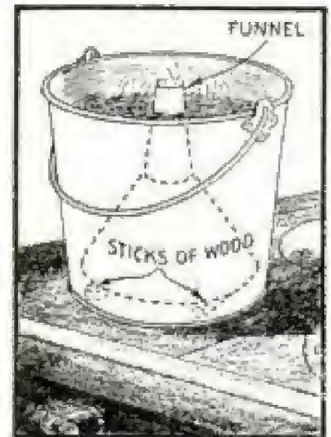


Unusual Construction Attracts the Eye to This Rotating Sign, Which Is Driven by an Electric Motor

ment and construction. It was built entirely from junk parts and therefore its cost was negligible. The sign is kept in motion by a $\frac{1}{4}$ -hp. electric motor hooked up to the gears of an old washing machine, which steps down the speed so that the sign turns slowly. Buggy wheels support the "paddle-wheel" blades of the sign, which were made of galvanized iron, and were hung on rods bolted to the rim of the wheels. These blades, with their advertising message, remain in a vertical position as the sign turns, and the sign can be read from either direction, the blades being lettered on both sides.

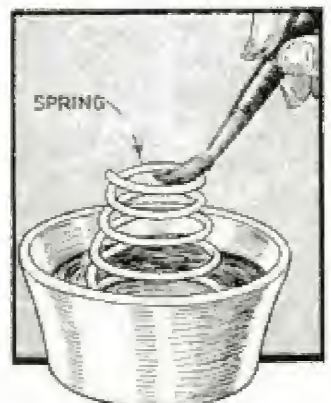
Funnel in Pail Makes Poultry Feed Cooker

To cook poultry mash quickly without burning it, place two sticks across the bottom of a pail, set an inverted funnel upon these and pour the grain around it, leaving about 1 in. of the spout projecting. Now pour water over the mash until it appears in the funnel spout, place it upon the stove and allow it to boil. Hot water will be ejected in spurts from the funnel and will cook the mash in a short time.

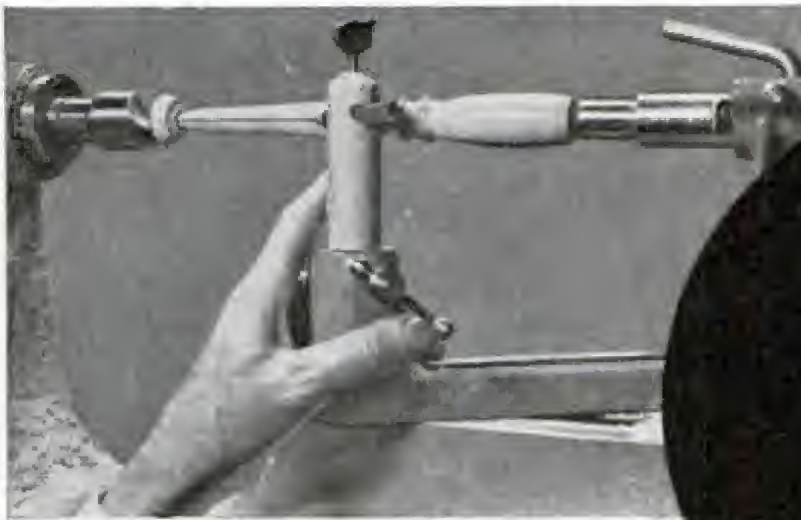


Coil Spring in Water Pan Helps to Clean Artists' Brushes

Soldered to the bottom of a water pan, a coil spring, of the type shown, will be found handy by artists to clean brushes when doing water-color work. The brush is dipped into the water inside the spring, after which the bristles are wiped off in the top coil.—Walter Newton, West Haven, Conn.



Marking Turned Work Parallel to Its Axis



Turned Work Marked Accurately in Your Lathe for Fluting



To accurately mark work held between centers in your wood-turning lathe, for dividing it into horizontal divisions as in fluting or reeding, turn a short piece of wood to the same diameter as the opening in the tool-post holder. Near the upper end of this piece, drill a hole to take a lead pencil, and a second, smaller hole in the end for a thumbscrew that will serve to lock the pencil in position. In use, insert the tool into the holder, adjust it

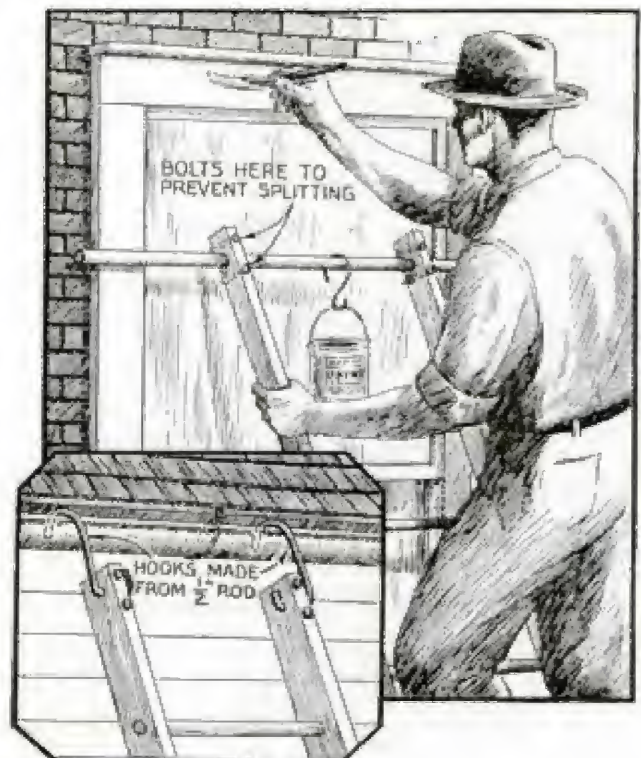
for height and then slide the holder along the lathe bed to make horizontal lines on the work, or lock the holder in place and turn the lathe by hand to mark lines around the work.

Crossbar at Upper End of Ladder Increases Its Usefulness

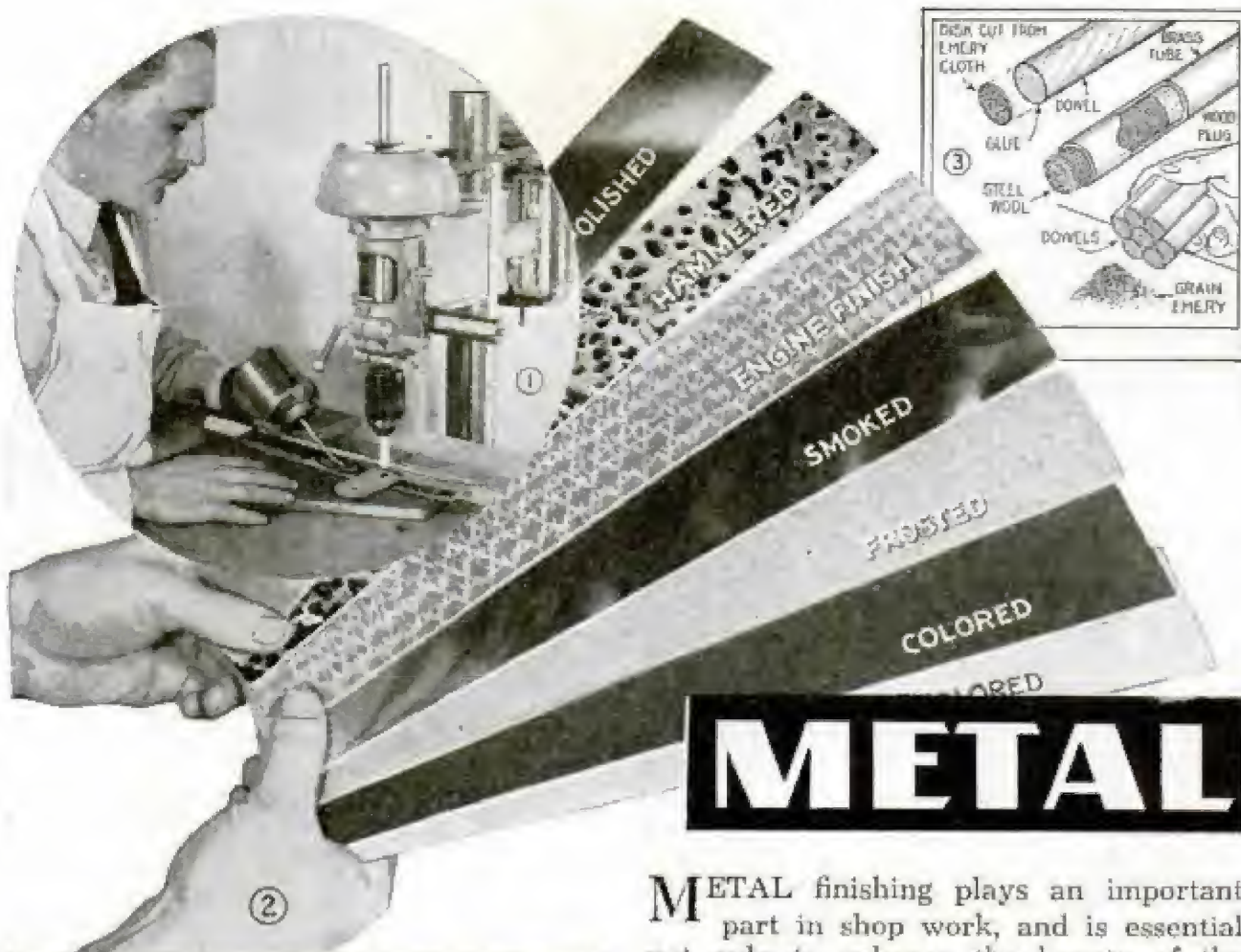
A ladder can be improved by drilling a $\frac{3}{4}$ or 1-in. hole through each side near the upper end. Then you can insert a pipe or broomstick to bridge openings such as doors and windows when working over them. A couple of hooks, made of $\frac{1}{2}$ -in. iron rod, may be substituted for the pipe so that the ladder can be fastened to the ridge of a roof when repairing it. Also, the hooks may be useful to hold the ladder on a gutter as shown in the lower detail, when there is a tendency for the ladder to slip sideways.

Improving Window Streamers

Sign painters who do large lettering on window streamers or other material where light shines through from the rear, are often troubled by having brush marks show badly, no matter how carefully the work is done. To remedy this, pat the lettering with sponge rubber. This removes the brush marks and gives a stippled effect.



Improving Your Ladder for Use in Front of Windows, Doors and Other Openings and on Roofs



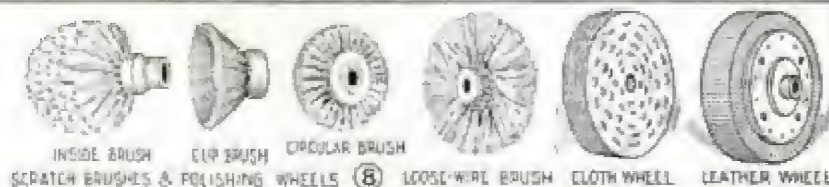
METAL

METAL finishing plays an important part in shop work, and is essential not only to enhance the beauty of the project but also to protect the finished work against tarnish and corrosion. Many different methods are used, all aiming at two important changes in the metal—its surface texture and its color. To these two might be added a third—the final process of applying protective coatings.

Texture is achieved largely by mechanical treatment. Some of the more common surfaces are shown in Fig. 2. Of these, the polished surface is perhaps the most popular. This finish is well understood by the average craftsman. In the case of rough castings, it includes the initial stages of grinding with abrasive wheels to remove prominent particles of metal. The surface is then successively treated with finer and finer cutting materials until the final polish is obtained. For average shop work, a

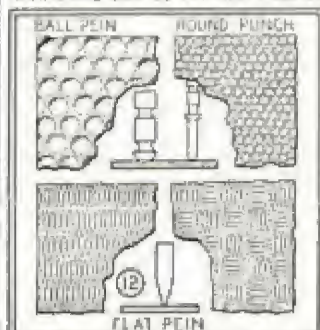


Various Types of Power-Driven Wire Brushes and Wheels Used in Polishing; These Are Obtainable in Diameters from 1 to 18 Inches





11 HAMMERING CAN BE HIT-AND-MISS OR



12 REGULAR PATTERNS CAN BE MADE



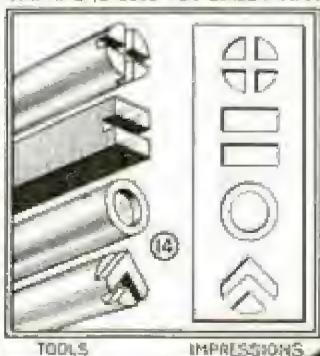
9 Sand-Blasting to Clean the Work or to Get a Dull, Mat Finish

FINISHING

in the Home Shop



13 MATTING IS GOOD FOR BORDER WORK



14 TOOLS IMPRESSIONS

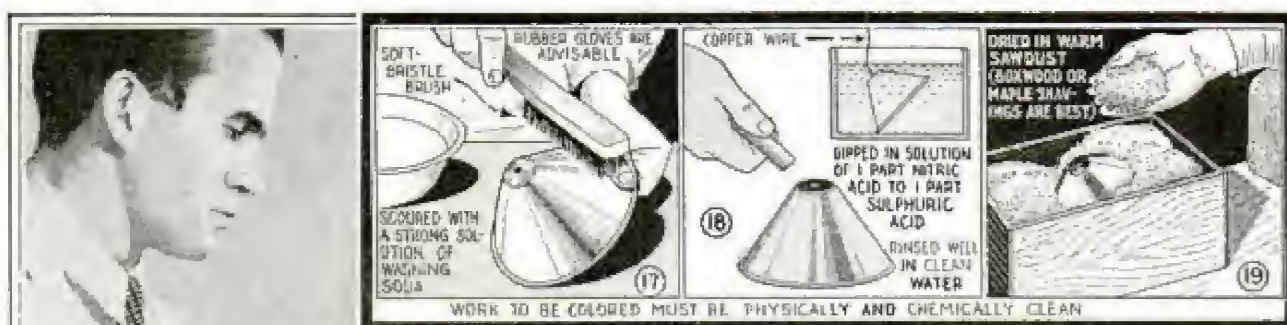
good polish on sheet-metal projects is obtained by successive applications of steel wool, pumice stone and rottenstone, as shown in Figs. 4 and 5. The final polish is not permanent. For a protective coating, articles which are not to be handled unduly should be lacquered with clear lacquer as in Fig. 6. Articles that are to be handled should be waxed and for this purpose, beeswax is commonly used. The work is gently warmed and then waxed, allowed to cool, and again briskly rubbed with a soft rag moistened with turpentine and wax.

Many accessories are used in obtaining the polished surface, notably wire scratch brushes and cloth and leather wheels. The hand scratch brush, Fig. 7, is common shop equipment,

and is useful in initial stages of polishing on the lathe. Power-driven wire brushes of various kinds are extensively used. Cloth wheels or mops consist of disks of calico, linen, swansdown, etc., stitched circularly, and procurable in diameters from 1 to 18 in. Some of these are shown in Fig. 8. Abrasives, such as emery dust, tripoli, crocus and rouge, are mixed with tallow, grease or wax to form a paste, which is then applied to the cloth wheel. Cloth mops are very handy when used with the fine abrasives mentioned in securing a high polish. A novel texture for sheet-metal surfaces is known as "engine finish,"



15 Many Attractive Metal Textures Can Be Secured by Hammering, Matting and Smoking Freshly Varnished Surfaces

**BLACK**

Potassium sulphide 2 oz.
 Ammonium chloride 2 lbs.
 Water 1 gal.

Use cold. Ammonium chloride can be omitted but less satisfactory color results. Rinse in water after securing desired depth of color. Fix with beeswax or lacquer.

RED-BROWN

Barium sulphide 2 oz.
 Water 1 gal.

Use cold or warm. Color will become a shade lighter on drying.

NUT BROWN

Ammonium sulphide 2 oz.
 Water 1 gal.

Use cold. Strength of solution can be varied. This deposit should be finished with clear lacquer.

RED

Copper sulphate 4 oz.
 Sodium chloride 2 lbs.
 Water 1 gal.

Use at 120° F.

BLUE-GREEN

Sodium thiosulphate (Hypo) 1 oz.
 Ferritate of iron 8 oz.
 Water 1 gal.

Use at 180° F.

VERDE GREEN (1)

Copper nitrate 5 oz.
 Ammonium chloride 5 oz.
 Chloride of lime 5 oz.
 Water ½ gal.

Use at 75° F. Color is improved by initial application of barium sulphide (¼ oz.) and water (1 gal.)

VERDE GREEN (2)

Acetic acid (vinegar) 1 qt.
 Sodium chloride (common salt) ¼ oz.

Use at room temperature. Apply with brush. Let stand 5 minutes. Mop off, repeat if necessary to secure required depth of color.

Formulas to Color Brass and Copper; the Solutions Are Applied by Brush or Immersion; Other Metals Should Be Copper-Plated before Treatment

and can be worked successfully with a suitable scratch brush or by the simpler methods shown in Figs. 1 and 3. As can be seen in Fig. 2, the finish consists of an over-all pattern of circles, usually applied in a regular pattern. Fig. 1 shows one method of working. The metal surface is covered with grain emery, well moistened with water. The tool used is simply a length of dowel stick, which works through a hole drilled in a suitable metal template. Some simple arrangement to space the circles regularly completes the set-up. Fig. 3 shows various tools for securing the same effect by dry methods. Disks cut from emery cloth can be glued to a length of dowel; a brass tube can be filled tightly with steel wool; dowel sticks can be treated with glue and then dipped in grain emery to obtain the desired surface. A frosted or mat surface is best obtained by sand-blasting as shown in Fig. 9. The effect is varied from a coarse frosting, by using silica sand, to a fine satin finish, by using fine-grain emery or coarse pumice stone. Many excellent effects can be obtained by masking certain portions of the work with gummed paper, as shown in Fig. 10.

More obvious surface textures are obtained by hammering, Fig. 11, or otherwise indenting the surface of the metal. The hammer strokes can be applied hit and miss, or geometrical patterns can be followed, as shown in Fig. 12. Matting is effective for border work. This is accomplished by using small punches which can be made from tool steel or even common nails. The application of this texture and the general idea of tool shapes should be apparent from Figs. 13 and 14. Indented textures appear to best advantage when the work is colored and the high lights burnished down to bare metal.

Fig. 15 shows the application of the popular "cloud" or "smoke" finish. This works

best on a mat surface obtained by scratch brushing or sand-blasting. The work is coated with a slow-drying varnish, and, while still "tacky," the surface is held over a smoky flame so that the deposited soot adheres to the varnish. The shading is best controlled in a darkened room. The finish is easily marred, and should be handled carefully until it can be fixed by immersion or spraying with clear varnish as in Fig. 16.

Color is an important part of metal finishing, both for beauty and for harmonizing one piece of metal with another. Barring paint and lacquer finishes, chemical action is most frequently used in effecting certain colors in brass and copper projects. Successful chemical coloring demands that the work must be absolutely clean. Greasy work should be washed with gasoline or benzine. Final traces of grease are then removed by scrubbing with a strong solution of caustic potash or washing soda, as shown in Fig. 17. When you do this it is advisable to wear rubber gloves. The work is then immersed in an acid bath or "pickle," as in Fig. 18. The solution specified is a bright dip and should be allowed to act on the work for a few seconds only. The work is rinsed in clean water and is then dried in clean, warm sawdust, as shown in Fig. 19. After drying, the work is rubbed with a clean, soft cloth, being very careful not to touch it with the hands, which would defeat the purpose of cleaning it. Use clean, rubber gloves to handle the parts. Then you are ready to immerse it into the coloring solution. However, drying with sawdust is not necessary if the work is to go to the color bath immediately, but should follow the color treatment. Chemical colors are many and varied, and they do little more than touch the surface. The formulas in the table of coloring solutions will give you considerable choice, and present no difficulties provided the work is perfectly clean. Colors obtained by chemical action are usually not permanent, but should be given a protective coating of beeswax or clear lacquer.

☛When India ink is used in quantities, it is cheaper to make it up yourself from the stick form. The stick is broken up into small quantities and allowed to dissolve for several days in weak ammonia water.

Scraper on Wagon Box Removes Clay and Gumbo from Shovels

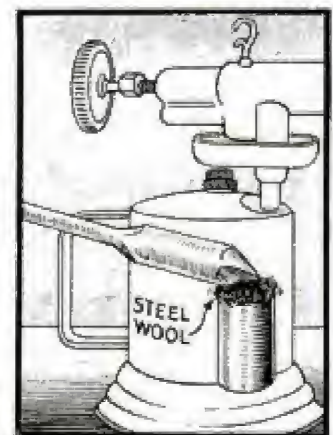


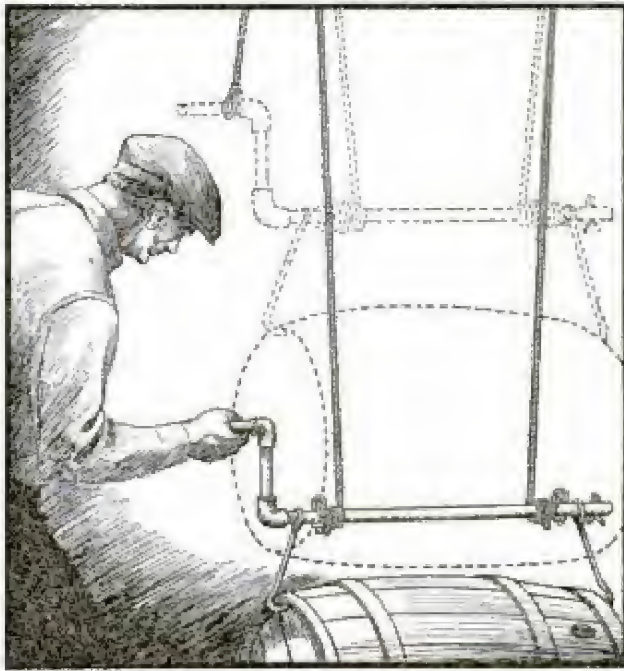
Scraper Made of Flat Iron and Screwed to Wagon Box for Cleaning Spade or Shovel

When hauling soil of clay or gumbo content, it is necessary to clean the blade of the spade or shovel frequently. Instead of stopping to do this with a hand scraper, one farmer screwed a piece of flat iron to the side of his wagon box where it could be used conveniently for this purpose.—G. E. Hendrickson, Argyle, Wis.

Steel Wool on Blowtorch Cleans Soldering Iron

For want of a cloth pad upon which to clean a hot soldering iron, many mechanics brush the point on their sleeve or trousers each time it is removed from the heating torch. A better method is to solder a tin tube to the side of the blowtorch and use it as a holder into which a roll of steel wool, waste or cloth may be forced and held as a wiping pad.





Simple Hoist or Windlass for Raising Oil or Vinegar Barrels in Stores to Dispense the Contents

Simple Hoist to Raise Vinegar or Oil Barrels

In retail establishments, where vinegar, oil or other liquid commodities are dispensed, the task of elevating the barrel to a convenient height is often difficult. If a pair of cables are suspended from the ceiling to support a crank assembly of pipe as shown, the work may be accomplished easily. The sliding hooks engage the chimes of the barrel, which is elevated by turning the crank. A third rope or cable, also suspended from the ceiling, is provided with a steel ring which may be slipped over the crank handle to hold the barrel at the desired height.

Horseshoe Aids in Using Hand Sifter

When small quantities of sand, or similar substances, must be sifted for some particular job, one contractor places a horseshoe on the screen as shown. In the operation of the sifter, the shoe slides back and forth, pulverizing the lumps and grinding the sand through the screen rapidly.



Piece of Hose Attaches Handle to Scrub Brush

In a dairy or milk station, where the cleaning of cans and vats makes it necessary to change frequently from a hand brush to an extension brush, a combination of both may be improvised by splitting a short piece of rubber hose and nailing it to the back of an ordinary brush. The extension handle may be inserted or removed in a jiffy.



Shavings Blower for Your Drill Press

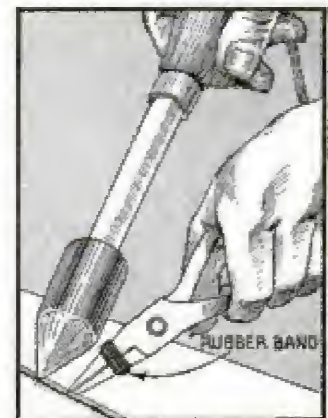


When drilling or routing in a drill press, shavings often collect and cover the guide lines or center marks. These shavings may be removed by using this blower, which is a rectangular piece of cardboard with slits cut in the center to fit on the drill bit as shown. Only cardboard should be used for this purpose,

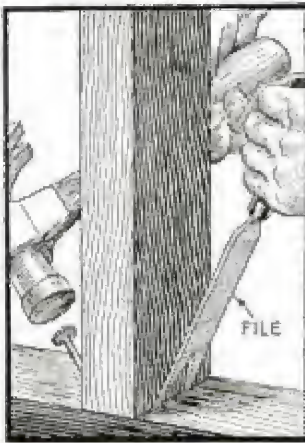
as heavier material might involve the risk of injuring the worker's hands.

Rubber Band Improves Small-Nose Pliers

A rubber band, wrapped tightly around the nose of a pair of small pliers, is an aid in holding small objects. The band holds the nose of the pliers tightly together so that small parts are not likely to slip out.



Simple Tool Aids in Toenailing Studs and Joists

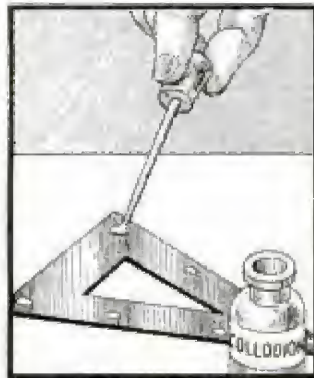


When toenailing studs, joists or rafters, carpenters will find this tool convenient, as it will hold the end of the stick squarely on the line while the first nails are driven. The tool is made by grinding one end of a discarded

file to a forked shape, and attaching a wooden handle by which it may be forced into place.

To Prevent Ink Smears from Triangle

Draftsmen who sometimes experience difficulty by having fresh ink lines smeared over a drawing when using a celluloid rule or triangle, will find that this trouble can be eliminated by applying a few drops of celluloid glue, or collodion, to the underside of the instrument. These dots, properly placed and allowed to dry, will serve as feet to elevate the triangle above the surface of the drawing.

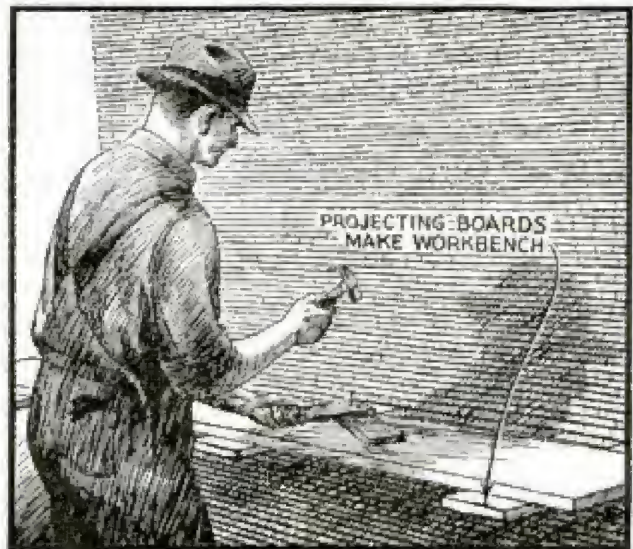


Clothespin Guide for Striping Brush

One of the simplest devices for guiding and gauging work with a fine striping brush is a common clothespin. The handle of the brush is wedged between the legs of the pin, the anchorage thus provided



being sufficiently secure for all practical purposes. If retracing is necessary, the guide will straddle the line so that paint is not smeared over the surrounding surfaces.



Boards Projecting from Pile of Lumber Serve as a Temporary Workbench for Retail Dealers

Boards Projecting from Lumber Pile Serve as Workbench

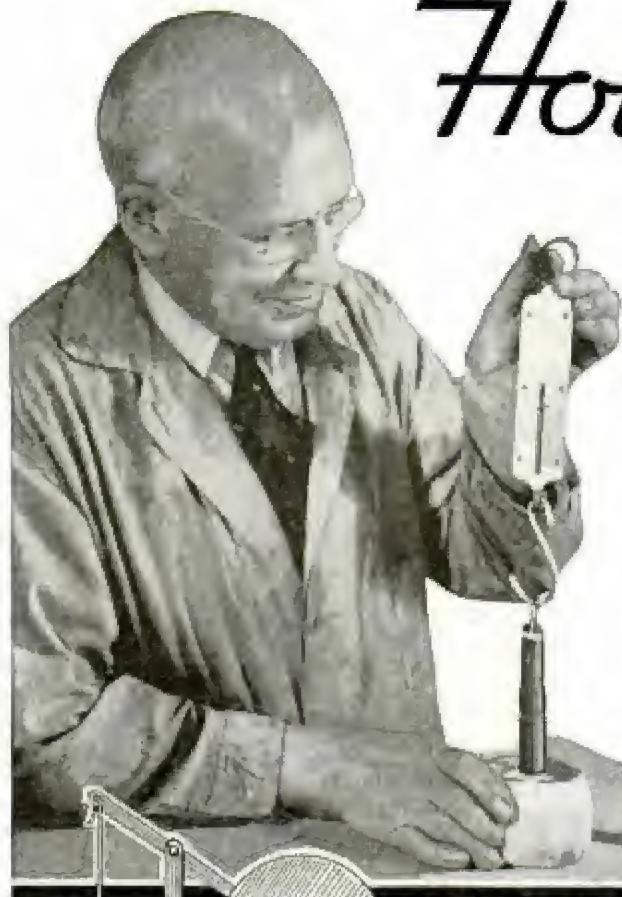
Retail lumber dealers whose trade requires certain squaring, ripping or other work on the stock delivered, will find that a few boards left projecting from the lumber pile will serve as supports for an improvised workbench for such operations. The same idea may be carried out in making steps to the top of the pile, only in this case each projecting board is above and to one side of each preceding one.

Spot of Glue Displays Samples of Sacked Seeds

When sacks of small seed, such as clover, alfalfa, timothy, etc., are opened to display the contents, much of the valuable commodity is scattered about and wasted by careless and inquisitive persons. To avoid this, one dealer dabs a spot of quick-drying glue on the descriptive tag of each sack, and then pushes it into the contents so that a portion of seed adheres. The sacks are closed again and the tags attached. From these tags, customers may examine the seeds.



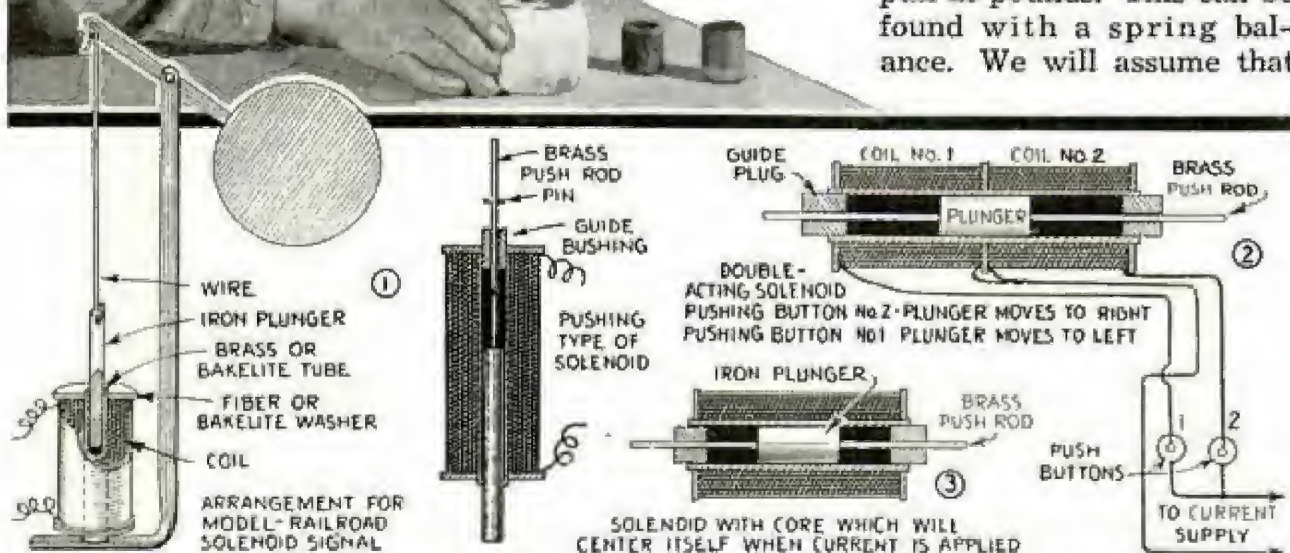
How to Make



stat will determine the force with which the solenoid will shoot the ball. Solenoids may be operated on either alternating or direct current but they must be designed for the particular kind of current on which they are to be used.

Simple D.C. Solenoids

To make the methods of design easy to apply to any problem we will go through the work step by step and completely design a solenoid for the operation of a valve. Fig. 4 shows the valve together with a suitable solenoid arrangement. After deciding on the mechanical arrangement, we must determine the amount of pull in pounds. This can be found with a spring balance. We will assume that



SOLENOIDS and plunger magnets are varieties of electromagnets capable of moving their cores. A number of forms are shown in Figs. 1 to 3 inclusive. The left detail in Fig. 1 shows a solenoid arrangement that can be used to operate a semaphore signal for a model railroad. The weight of the semaphore arm should be slightly greater than the weight of the iron plunger, which is pulled into the coil when the current is turned on. Fig. 7 shows a method of shooting steel balls with a solenoid which can be used in the construction of popular games of skill. A radio rheostat is connected in series with the solenoid and the setting of the rheo-

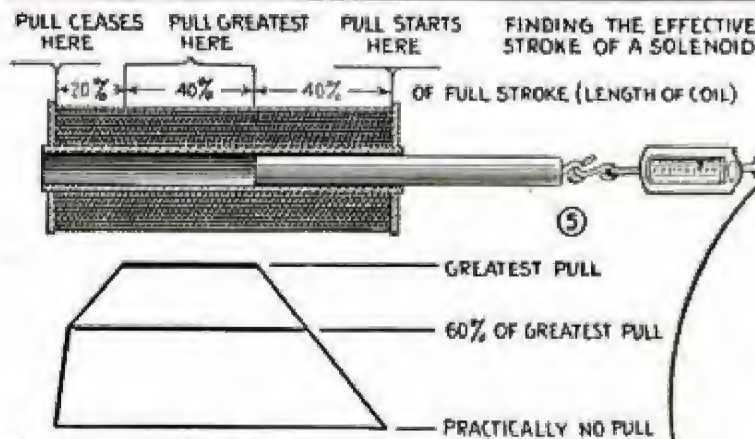
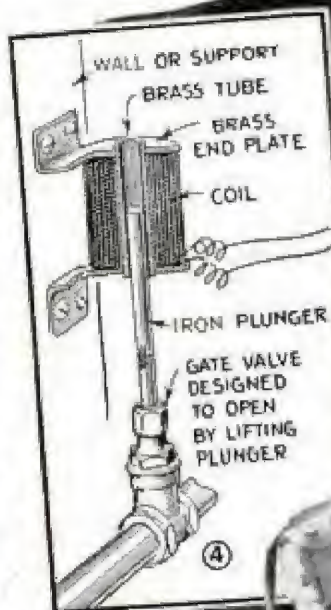
stat will determine the force with which the solenoid will shoot the ball. Also we will need to measure the distance in inches through which the plunger must be moved to open the valve. This value will be the required stroke for the solenoid. Measuring the distance, we find it to be $1\frac{3}{4}$ in. To be on the safe side, we will design our solenoid for a 2-in. stroke to allow for wear. Having these values we are ready to start to work. The pull required, or 2 lbs., will have to be increased somewhat to take care of the weight of the plunger and friction. The exact amount of these values cannot be determined, so we will assume a safe value for them and build our solenoid accordingly. If we

SOLENOIDS

by
C.A. Crowley

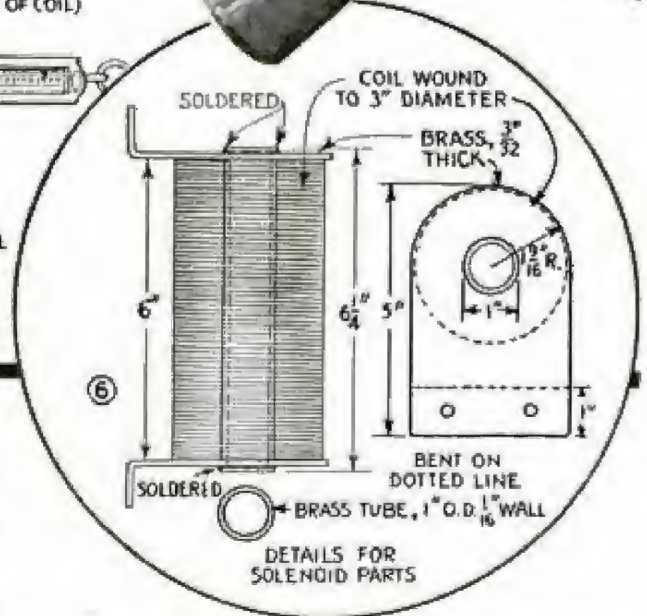
build the magnet to lift 5 lbs., we will be on the safe side.

We could go through the process of figuring out the exact diameter of round iron rod, which should be used for the core, but it is usually necessary to use the size which is at hand and make the other values fit, and this is quite safe if a little judgment is used in selecting a suitable size. For the pull required in this case a rod having a diameter anywhere from $\frac{3}{4}$ to 1 in. would be satisfactory. Having a length of $\frac{7}{8}$ -in. soft-iron rod at hand we will use it. For stronger pulls correspondingly larger cores should be used except in cases where the stroke is very short.



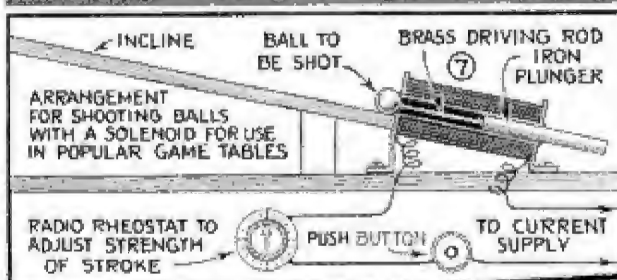
Length of Plunger and Coil

The length of the core should be made at least $2\frac{1}{2}$ times the length of the stroke, so we will cut off a piece of the $\frac{7}{8}$ -in. rod 7 in. long to allow for coupling it to the valve stem. Next we get a thin-walled brass tube just large enough to slip freely over the rod. The tube will be used to support the coil and should be cut about $\frac{1}{4}$ in. longer than the required length of the coil. The coil is also made at least $2\frac{1}{2}$ times the length of the stroke, or 6 in. long, to correspond with the plunger, so the brass tube should be $6\frac{1}{4}$ in. long. The additional length is included for mounting end washers to hold the winding in place.



They may be of brass, aluminum, fiber, bakelite or any other non-magnetic material which is available.

It is safe to multiply the length of the stroke by $2\frac{1}{2}$ to get the approximate coil length for solenoids which have long strokes such as this one. However, short-stroke solenoids must frequently be made three, four, or even five times as long as



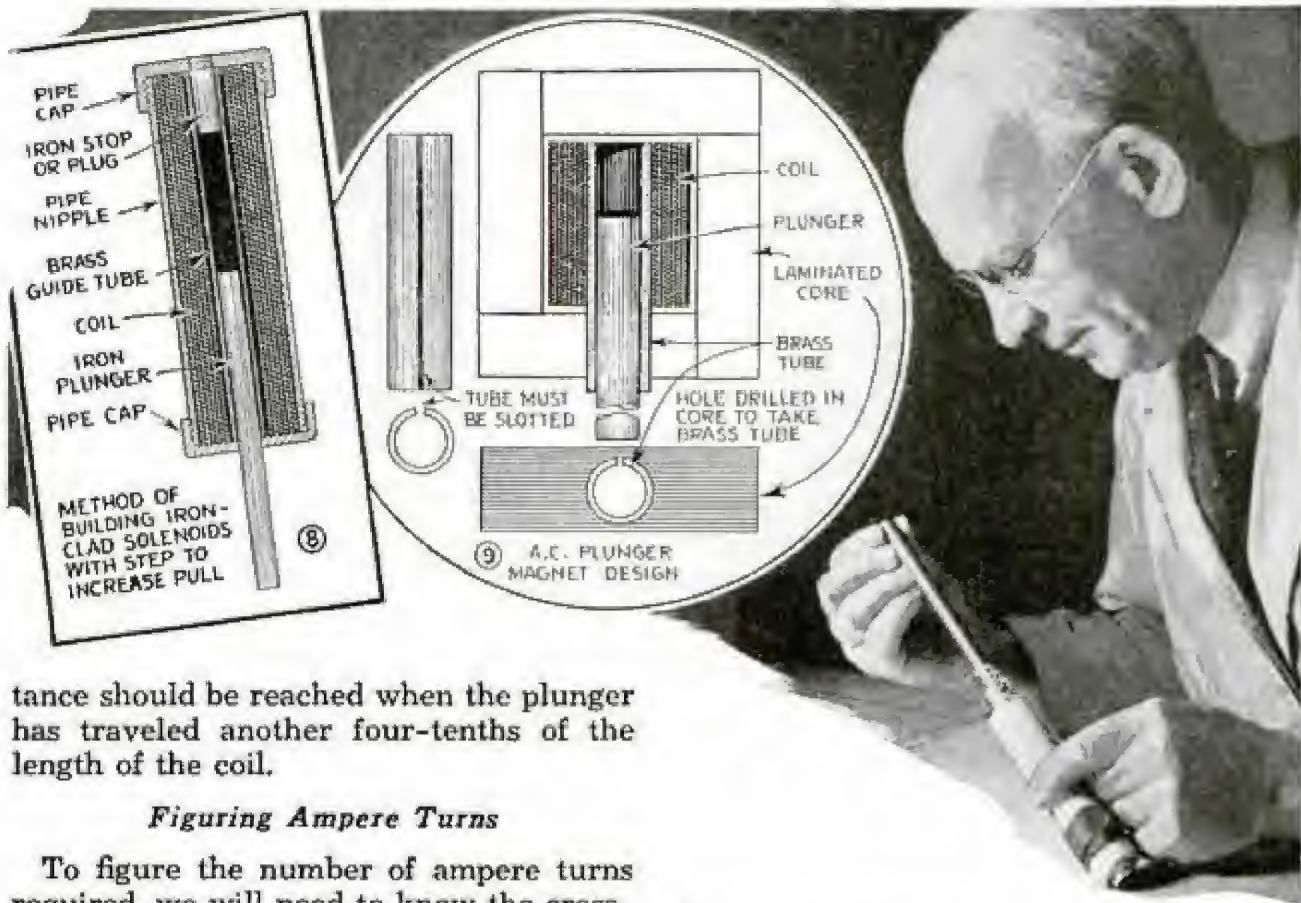
their stroke in order to prevent their windings from becoming too hot. The safe side is to make the coil as long as possible without making the unit bulky and out of proportion. Lengthening the coil also increases the distance through which the solenoid will exert its maximum pull, thus making it considerably more effective.

Pull of Solenoids

Although solenoids give some pull on their cores from one end of the coil to the other, the best results are obtained when only the most effective part of their stroke is being used. Fig. 5 shows exactly which sections of the inside of any coil may be expected to give the most pull. From this diagram it can be seen that the greatest pull is exerted when the plunger has been inserted four-tenths of the length of the coil. This same maximum pull continues to be exerted until the plunger has traveled for another four-tenths of the coil length. From this point to the end of the coil the pull falls off slowly and at the end it becomes almost nothing at all. Accordingly, solenoids should be designed so that their plungers rest at a point four-tenths of the way in the coil when the current is off. The end of the stroke or working dis-

WIRE TABLE

B & S or A. W. G. Number	Ohms per 1000 Ft. at Coil Temperature	Circular Mils	TURNS PER SQUARE INCH				OHMS PER CUBIC INCH			
			Enamel Covered	Single-Cotton Covered or Double-Silk Covered	Double- Cotton Covered	Enamelled and Single-Cotton Covered	Enamel Covered	Single-Cotton Covered or Double-Silk Covered	Double- Cotton Covered	Enamelled and Single-Cotton Covered
8	.764	18510				84.8	.00765	.00725	.00662	.00704
9	.863	16090			80	105	.0121	.0115	.0102	.0110
10	1.215	10380	92.2	87.5	97.5	131	.0193	.0181	.0160	.0173
11	1.522	8234	116	110	121	162	.0308	.0283	.0250	.0271
12	1.931	6530	146	136	150	198	.049	.0443	.0385	.0417
13	2.436	5178	184	170	183	250	.078	.0697	.0592	.0665
14	3.071	4107	237	211	223	306	.122	.107	.0907	.102
15	3.873	3257	293	262	271	372	.194	.168	.139	.157
16	4.884	2583	365	321	329	454	.294	.262	.213	.242
17	6.158	2048	460	397	399	553	.437	.397	.318	.370
18	7.765	1624	572	493	479	675	.674	.657	.530	.615
19	9.792	1288	718	592	575	825	1.23	1.01	.806	.957
20	12.35	1022	912	775	754	1010	1.91	1.54	1.22	1.43
21	15.57	810	1150	940	910	1260	3.01	2.38	1.82	2.20
22	19.63	642	1430	1150	1080	1570	4.78	3.64	2.70	3.37
23	24.76	510	1780	1400	1290	1910	7.66	5.61	4.10	5.18
24	31.22	404	2240	1700	1510	2300	12.1	8.50	5.95	7.82
25	39.36	320	2820	2060	1750	2780	19.0	13.0	8.66	11.9
26	49.64	254	3560	2500	2020	3350	30.2	19.8	12.5	18.1
27	62.59	202	4420	3030	2310	3900	47.3	29.5	18.5	26.7
28	78.93	160	5580	3670	2700	4680	75.2	43.6	26.2	40.3
29	99.52	127	6990	4300	3070	5280	116.	64.0		57.0
30	125.5	101	8700	5040		6250	185.	95.5		85.5
31	158.2	80	10700	5920		7350	293.	140.		177
32	199.5	65	13500	7060		8310	460.	209.		281.
33	251.6	50	17000	8370		9700	721.	300.		396.
34	317.7	40	21100	9690		10700	1110.	422.		570.
35	400.1	32	26300	10900			1740.			
36	504.5	25	32000	12700			2710.			
37	636.2	20	39800				4250.			
38	802.2	16	49400				6600.			
39	1012	12	61200							
40	1276	10	76100							



tance should be reached when the plunger has traveled another four-tenths of the length of the coil.

Figuring Ampere Turns

To figure the number of ampere turns required, we will need to know the cross-sectional area of the plunger. The diameter of the plunger is $\frac{7}{8}$ or .875 in. To find the area we first square this diameter, or in other words multiply it by itself, or .875 times .875 which equals .765. Next we multiply this number, or .765 times 3.1416, which equals 2.4. To get the cross-sectional area we divide by 4 which gives .6 sq. in. as the cross-sectional area of the core. To find the ampere turns required multiply 100 by the length of the coil and the pull in pounds and then divide this answer by the cross-sectional area as just figured. Performing this multiplication we get 100 times 6 times 5, which equals 3,000. Dividing this by the area, or .6, gives us 5,000 ampere turns required.

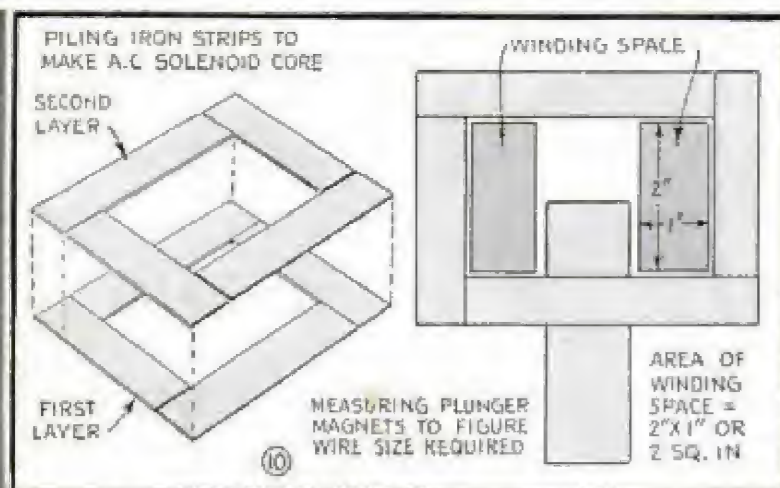
Size of Finished Coil

The outside diameter of the finished coil is next figured by multiplying the diameter of the brass tube by 3. In this, we get 3 times 1, which equals 3 in. as the diameter of the finished coil. This general rule for deciding the outside diameter of finished coils is satisfactory for long-stroke solenoids. However, the diameter of coils designed for a short stroke should be made larger in proportion. For a stroke of less than $1\frac{1}{2}$ in., the outside diameter

of the coil usually should be made four times the diameter of the core or plunger. For those to have strokes of less than $\frac{3}{4}$ in., the outside diameter may have to be made between six and eight times the diameter of the plunger. The shorter the solenoid and the smaller the diameter of the plunger, the greater will the diameter of the coil have to be. Wherever possible, with short-stroke solenoids, the length of the solenoid should be increased so that the diameter does not have to be made too great.

Finding the Size of Wire to Use

Knowing the outside diameter of the coil, we can figure the perimeter or length of the average turn of wire required to wind the coil, and then with this value finish the design by calculating the size of wire. The average perimeter is found by adding together the inside and outside diameter of the coil and then multiplying this sum by 1.8. Measuring the brass tube, we find it to be 1 in. in diameter. Adding this to the outside diameter of the coil as just determined, or 3 in., we get 4 in. Multiplying this answer by 1.8 gives us 7.2 in. as the average length of all the turns to be wound on the coil.



Special Types of Solenoids

Fig. 8 shows a special form of solenoid known as "ironclad." It has an iron stop to limit the stroke and increase the amount of pull. In this type, the pull is considerably greater than with ordinary solenoids due to the effect of the additional iron.

Solenoids for A.C.

Ordinary d.c. solenoids for low voltages may be adapted to equal a.c. voltages by simply using two sizes larger of wire for their windings. However, this method is not satisfactory for units designed for higher voltages than those commonly furnished by toy transformers. A type of solenoid design suitable for operation on a.c. is shown in Fig. 9. The iron core must be made from transformer laminations to prevent excessive heating. Old transformer cores are quite suitable if modified as shown. The plunger may be made from solid iron if the solenoid is to be used only intermittently. The pull of this type depends upon the cross-sectional area of the plunger. This may be figured from its diameter by the same method as was explained for d.c. Each square inch of plunger cross-section will hold approximately 80 lbs. However, the pull at the start of the stroke is considerably less.

The number of turns of wire required for a.c. solenoids to operate on 60 cycles is found by multiplying the volts by 5 and dividing by the cross-sectional area of the plunger. For 25 cycles, the volts are multiplied by 12 and the product divided by the cross-sectional area of the plunger to get the number of turns. The largest size of wire, which will give the required number of turns and fit the space in the core

The proper size of wire to use is now figured in two steps. First we multiply 12,000 times the voltage on which the coil is to be operated. For operation on 110 volts we will multiply 110 times 12,000 and get 1,320,000. Into this number we next divide the product of the ampere turns and the average length of each turn, or 5,000 times 7.2, which gives 36,000. Dividing this number into 1,320,000 gives 36.6 as the wire size in ohms per 1,000 ft. Consulting the wire table, we find that this value lies between No. 24 and No. 25 wire. Selecting the smaller, or No. 25 wire, will produce a cooler running coil without serious loss of power. Now it is only necessary to fill the winding space with even layers of wire without counting. The exact number of turns is not important as this size of wire will produce the proper number of ampere turns regardless of the exact number of turns, so long as it is wound into the space figured for it. The solenoid may then be constructed from a drawing as Fig. 6. The outfit should be adjusted so that the plunger rests with its end four-tenths of the way into the coil when the current is off.

after allowing for insulation, should be used. The wire table gives the number of turns per square inch for all common sizes of wire. To illustrate the method we will figure the size of wire needed to wind an 800-turn coil for the solenoid shown in Fig. 10. The window opening available for winding after allowing for insulation is $\frac{3}{8}$ by 2 in. Multiplying these together we get .750 sq. in. of space. Dividing this number into the turns required or 800, we get 1,066 as the number of turns per square inch. Consulting the wire table under the columns headed "Turns per square inch" and selecting values next larger than 1,066 we find that the largest wire we can use is No. 21 enameled wire, which will wind 1,150 turns per square inch. If this is not available we can use No. 22 single cotton-covered or enameled and single cotton-covered, or if necessary use No. 23 double cotton-covered. The No. 21 enameled would give the greater current-carrying capacity, due to its larger size. Coils for a.c. solenoids should be wound on forms like transformer coils and installed afterward. If brass or other non-magnetic metal tubing is used as a guide for the plunger of an a.c. solenoid it should be slit from end to end to prevent it from getting hot. In building solenoids care should be exercised to effectively insulate the coils to prevent grounds and shorts. Metal spools should be covered with brown paper before winding on the wire. Finished coils may be permanently protected by impregnation with insulating varnish, and baking. Design figures for solenoids are only approximations, and real skill in design can be acquired only by experience in the shop. Therefore, it may be necessary to make several trials to produce a special type of solenoid to meet a particular requirement.

Simple Repair for Sagged Filament in Bulb of Tungar Charger

When the filament of a Tungar battery charger sags until the gap between it and the carbon button is too large, you can often get many more hours of service from the bulb by inverting it so that the filament hangs downward. This is done easily by removing the bulb and socket and remounting it.

Push Stick Useful When Sawing Narrow Strips



Counterweighted Push Stick Suspended above Circular Saw Always at Hand When Needed

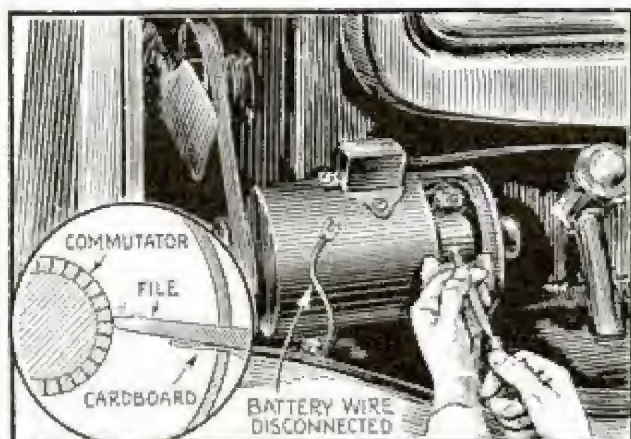
Suspended from a counterweighted cord, this push stick for use with a circular saw is always at hand. The cord is run over a pulley screwed into the ceiling above the saw so that it is only necessary to reach up and pull down the stick when needed. A large knot tied in the cord at the proper place will keep the weight from pulling the stick out of reach.—Wayne M. Judy, Clear Lake, Ia.

Preventing Lumpy Sugar in Barrels

Grocers who keep brown sugar in barrels often experience difficulty by having it become lumpy in a short time after the barrel has been opened. If a piece of burlap is used as a cover, and is dampened every few days, the contents of the barrel will remain in a granular form.



Generator Commutator Trued Up without Removing Armature

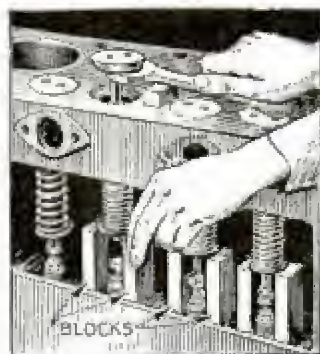


File Used in a Manner Similar to That of a Lathe Cutting Tool to True Up Generator Commutator

In an emergency a three-cornered file may be used to true up a worn commutator on a generator. The end of the file is ground to the shape shown, after which it is used as a cutting tool in a manner similar to that of a cutting tool on a lathe. After removing the battery wire from the electrical cut-out, the motor is started and run at idling speed. Then the ground end of the file is held against the commutator, steadying the file on the generator housing. Before starting the work, place a piece of cardboard between the file and housing to avoid a short circuit. Hold the file steady, resting one finger against the housing as a guide, and take very light cuts.—S. R. Bobowski, Chicago.

Blocks and Wrench Serve as Emergency Valve Lifter

After removing the cylinder head to grind the valves on my car, I found that the only valve lifter available would not work. To obviate this difficulty, I turned the motor over to raise the valve. Then, with an end wrench and a small block, the

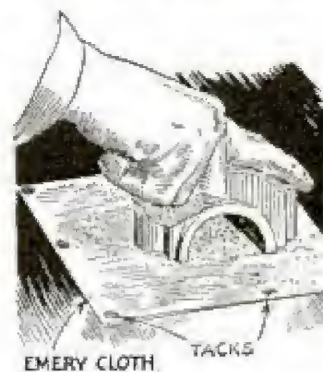


valve was raised still higher as shown, after which short blocks were set under the spring to keep it compressed. It was then a simple matter to push the valve stem down and remove

the keeper, leaving the blocks in place until the valve was finished, after which the keeper was replaced and the blocks removed.—Tom H. Hopes, Lakewood, Ohio.

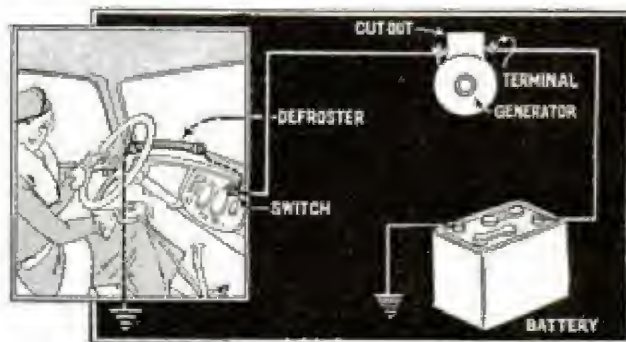
Connecting-Rod Bearings Dressed Down with Emery Cloth

Tacked to a smooth board or bench top, a sheet of fine emery cloth provides an abrasive surface on which to dress down connecting-rod bearings. Use of emery cloth in this way assures that both ends of the bearing will be dressed down uniformly. It is a good idea to wash the bearing in gasoline to remove any particles of emery before putting it on the shaft.—Spencer A. Jones, Belleville, N. J.



Car Accessories Automatically Shut Off When Motor Stops

To avoid leaving a heater, defroster, or other accessory turned on when your car is parked, connect the accessories so that they are automatically shut off when the generator stops charging. To do this, one side of the accessory is connected to the electrical cut-out terminal that leads from

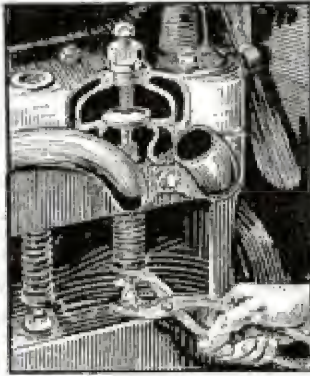


Heater or Windshield Defroster Connected to Electrical Cut-Out Is Automatically Shut Off

the generator, while the other side, of course, is grounded. The same result can be had on some cars by connecting the accessory to the "dead" terminal of the ignition switch so that the circuit is broken when the switch is turned off.—P. F. Rossman, Detroit, Mich.

Tool Holds Down Valve to Insert New Spring Keepers

When it is necessary to compress a valve spring to replace a broken or bent spring keeper, a tool can be made from the shell

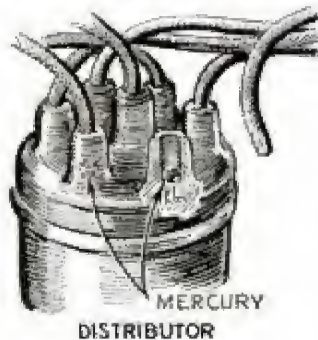


of an old spark plug to hold down the valve without removing the cylinder head, provided the motor has the valves under the spark-plug coils. The shell is tapped inside to take a long stud or cap screw.

In use, the tool is screwed into the spark-plug hole above the valve to be repaired, after which the cap screw is driven down against the valve.—A. O. Stanfield, Orange, Calif.

Assuring Electrical Contact of Spark-Plug Cables

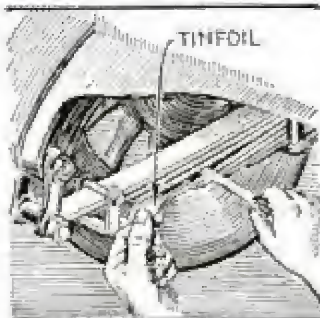
Cables leading to spark plugs sometimes loosen in the sockets of the distributor head so that good electrical contact is not made. To avoid this, add a few drops of mercury to each socket. Mercury, being a good conductor of electricity, assures perfect contact in the sockets.—G. R. Hampton, McCamey, Tex.



Tinfoil Helps Eliminate Squeaks in Car Springs

Squeaks originating between leaves of elliptic or transverse springs can be eliminated by inserting a strip of heavy tinfoil about 4 in. long between the leaves near the ends. Also, the tin-

foil will make frequent spraying of the springs unnecessary.



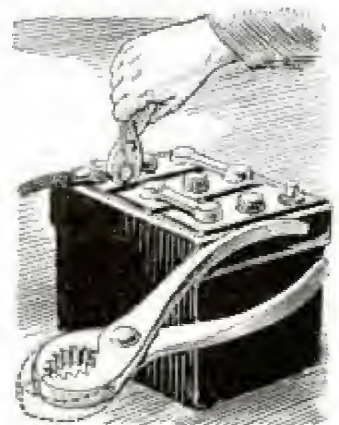
Tire Valve Soldered to Gas-Tank Cap for Use in Clearing Clogged Fuel Line

Blowing Out the Gas Line with Your Tire Pump

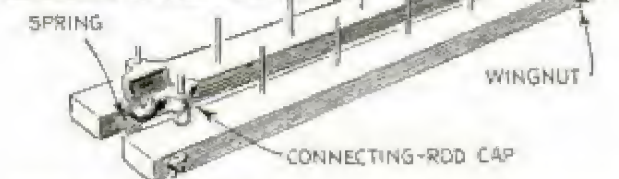
An extra gas-tank cap fitted with a tire valve as shown, and carried in your car, may save you a towing charge, should the gas line become clogged on the road. If this happens, just substitute the altered cap for the regular one, disconnect the line at the fuel pump or vacuum tank, and then use your tire pump to build up a pressure in the gas tank. This will usually force out the foreign matter in the line. Care should be taken not to build up too great a pressure inside of the tank as you may damage it.

Pair of Pliers Altered for Battery Work

When a pair of pliers is used to loosen or tighten nuts at a battery terminal, there is a possibility of the nose of the pliers damaging the top of the battery. To eliminate this difficulty, round off the nose of the pliers, as shown, on a grinding wheel. Grind off enough metal to allow the pliers to clear the top of the battery as the nut is turned.



Rack to Keep Bearing Caps in Order



Rack to Hold Nuts, Shims and Bearing Caps Keeps Parts in Order When Overhauling a Motor

When overhauling a motor, this rack will be found handy to keep bearing caps, nuts and shims in order, thus preventing any possibility of getting them on the

wrong bearing. The rack is made from two pieces of 1 by 2-in. wood. These are held parallel to each other by bolts as shown, compression springs being slipped over the bolts between the pieces so that the rack can be adjusted in width. Short pieces of $\frac{1}{4}$ -in. iron rod projecting vertically from the rack hold the caps.

Two Time-Saving Kinks That Help Chevrolet Mechanics

To tighten a loose flywheel on a Chevrolet without removing the rear end, transmission and clutch, cut a 1-in. hole near the flange to which the clutch is bolted. By using a $\frac{3}{16}$ -in. socket wrench, the job can be done in about one hour. When replacing a connecting rod in a Chevrolet motor, it is not necessary to remove the cylinder head and take out the piston if the piston pin is slightly worn. Just drop the oil pan, remove the connecting-rod bearing from the crankshaft, and lower the piston until the pin can be taken out. —J. L. Baker, Cooper, Texas.

The Next Issue

WASHED AIR IN YOUR HOME

An inexpensive, homemade conditioner that washes, humidifies and circulates heated air uniformly throughout your home. Conditioner attaches to a hot-air furnace with slight alterations, and it can be controlled automatically.

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E 732

Tattletale Trade-Marks of Crime

(Continued from page 507)

tives to predict in advance where a criminal will operate. A forger left a long trail of bad checks in southern California. Deported at the end of a prison term, he was seen later in Louisiana. Deputy sheriffs at Los Angeles, warned by a secret tip, were on the alert. They were sure he would come back to his old territory. Down from the shelves came records, and detectives picked out his M. O. He always traveled by bus. When arriving in town, he always rented an apartment. He always laid in a supply of wine.

Noting that he had operated in suburban cities, detectives picked out Burbank as the most likely place for him to operate. Then they warned business men to be on the lookout. A few hours later, a real-estate agent was visited by a man answering the description. He wanted to rent an apartment. The agent found him a place, saw him write a check and receive \$2.50 in change, then slipped to a telephone and called the police. The officers got their man—only sixty hours after their first tip!

Every criminal has his pet method, either from force of habit, or because he is familiar with that method. No matter how he tries to vary his routine, his telltale habits of thought and action constantly betray him. A series of robberies began to harass Berkeley and Oakland, Calif. Always it was a railway station that was struck. The police analyzed the M. O. of the crimes and found four clues that pointed to the same man: his vulgar language, the way he approached the place, the hour of the day, always the same, and a threat made on leaving. The rest was easy. At the hour when this man operated, every railway station within a fifty-mile radius was protected. As the bandit entered the scene of his next hold-up, he was killed as he attempted to flee.

Again, a series of burglaries of stores over a period of years put the police on the trail of a mysterious "hole-in-the-wall" burglar. Always he entered by digging out the bricks until he made an opening large enough to crawl through. Finally, it was suggested that detectives "clock" locations, dates, and hours of the crimes. This chart revealed several astonishing things. First, the crimes centered about a

single neighborhood, indicating that a single local person probably was responsible. Second, that during certain months of the year, the crimes ceased. It was decided the criminal periodically left the city for some unknown reason. Detectives thought of the fleet of boats which goes to Alaska each fishing season. From the principal packing company they obtained a list of residents among the crew. Narrowing it down to a dozen or so who lived near the circle of crime, they found some who had police records, but none that could be connected with any of the burglaries.

Then they sent the material to Washington for comparison with department of justice files. Back came word that an ex-convict had a record whose fingerprints tallied with those left at the scene of a burglary. The police followed him. Late one night, detectives watched him go out and return a few minutes later with a load of stolen goods. He was killed by police bullets as he attempted to flee with the loot.

The chattering black machines used in M. O. analysis may be put to new uses as their possibilities are further explored. For example, witnesses who look at police "rogues' galleries" to identify a criminal, often become so confused that soon they cannot tell one picture from another. But by a system of "portrait parle," invented by Alphonse Bertillon, every feature of a human being may be classified into types. Eyes, face, forehead, nose, lobes, eyebrows, wrinkles, hair, posture and general appearance, may be cataloged. If by questions, the witness could identify these types, a composite portrait could be built up, and only those photos answering this description, be picked out by the mechanical brain.

Linking the major police departments of the country by its common language, the scientific method of fact-recording is forming a nation-wide net from which a criminal cannot hope long to escape.

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Machine-Made Heroes of the Gridiron

(Continued from page 522)

waist so the player has the sensation of tackling a live opponent. Others are encircled with heavily padded rings, not unlike automobile tires, to protect the player. The rings are fitted with strap adjustments so they may be raised or lowered.

One of the latest developments in football apparatus is a device which virtually combines all field equipment into one compact unit. With this machine, a player can be instructed, drilled and developed in all types of charging, blocking and tackling, under conditions closely approximating those encountered in a regular game. The padded dummies of these steel machines are shaped like a player in a defensive line stance, enabling the tackler to get the feel of the block. Regardless of whether the player hits the dummies high, low or in the middle, virtually the same spring reaction is offered. The machine has a sliding base made of twelve-gauge steel plate and is so balanced that it offers equal resistance no matter which way it is shoved.

Faulty charging, blocking or tackling is instantly detected when this machine is used. If the player lacks the all-important "follow-through" upon contact in the execution of a charge, block or tackle he will be repulsed exactly as if he encountered the superior force of an opponent, due to the recoiling force of dummy and sliding base. Or, if a man's feet are not as wide apart as they should be, he will lose contact with the apparatus just as he would lose contact with his opponent. This apparatus also offers the elements present in actual running shoulder blocks without injury to the player. The machine is set in the position of a defensive end at the time the running guard would contact him. The guard lines up in normal stance, pulls out of the line, focuses his eyes on the target and drives in with a running shoulder block, following through just as he would in a game. Thus, a player can drive full force and meet greater than live opposition without possibility of injury to himself or to a teammate acting as "cannon fodder."

The large frame charging sleds in most football camps aid in the development of a line's shoulder power and teach the value

of low charging and quick starting. Against a sled with seven padded posts the seven players take their respective places about the same distance as they would from their opponents on the line of scrimmage. When the signal is given they throw one shoulder against the post and the machine lunges backward. After two or three charges the players are given a short rest, then sent against the machine for a series of charges with the opposite shoulder.

Forward passers improve arms as well as their aim by tossing footballs through old tires suspended from a framework, and backs learn the art of side-stepping and getting their knees high in the air by hopping in and out of bottomless grocery boxes staggered in a line.

The guesswork connected with a line-man's job is eliminated by an indicator which also prevents the loss of a game due to touchdowns not being allowed when the ball has been carried across the goal line and subsequently pushed back into the field of play. It consists of two poles connected by a ten-yard chain. On each of these poles is mounted a sighting tube which contains reflectors and vertical cross hairs. By means of these reflectors it is possible to see the images of two flags, one in each corner of the field at the intersection of the end line and the side line. When the images of these two flags appear on the reflectors of the sighting tube directly opposite each other and identical, then the instrument is in adjustment, that is, the pole is vertical and the line of sight is at right angles to the side line—conditions necessary for taking a sight on the ball. If the forward point of the ball comes up to the vertical hair in the sighting tube the ball has been advanced ten yards, and a first down results.

Placed in a prominent position at one end of the playing field, the time-clock meeting with favor on several fields is operated by electricity with the control button in the hands of the game's official timekeeper. Its hands move clockwise and show the number of minutes and seconds remaining in each quarter. When a "time-out" occurs, it can be stopped, then started when play is resumed, thus keeping an accurate check on the game.

They changed a *CHOPIN WALTZ* into a *Dancing Light!*

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Scientists in the "House of Magic" have made it so... creating a radio packed with novelties and surprises.

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New metal tubes* that have silenced forever the annoying crackle caused by shielding cans... subdued the microphonic twang that clouds reception.

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Sets that make the world your radio playground... from \$34.50 up!



SEEING SOUND...INVISIBLE SOUND...IN THE "HOUSE OF MAGIC"! They don't trust the human ear, in the G-E Research Laboratory, to gauge the purity of radio tone. Instead, they have devised ingenious instruments that change spoken words, bars of music into waves of green light. Thus, the hidden secrets of sound are revealed... the causes of unwanted noises discovered—and eliminated.



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The new 1936 GENERAL ELECTRIC RADIO

When writing to advertisers please mention *Popular Mechanics*

Night Owls of the Air Lines

(Continued from page 516)



*Pilot at the Controls of One of the Big Airliners
Which Is Directed by Radio*

asks, "Surface wind, please?" He is still fifteen miles from the airport and the prompt reply gives him time to change his course so he can land straight into the wind without circling the field."

When flying a radio airway all planes keep to the right of the center of the beam. As another precaution, planes bound east or north fly at even thousands of feet, while planes headed south or west stay at altitudes in odd thousands of feet. When there are several sections along the same route, the fastest plane leaves first.

Radio is chiefly responsible for the new safety in the air and the equipment is vastly improved over the sets a few years ago. Fading and "dead zones" have been overcome greatly. A few years ago the pilot of a transport coming in to Los Angeles found the field hemmed in by clouds. By talking with the airport he would be able to make a safe landing but the radio operator on the ground gave no indication he had heard the pilot's questions. The airport could hear the plane's radio but due to a freak condition the pilot couldn't receive messages from the field. The operator on the ground listened to the sound of the

plane's motors and radiophoned their position to a station in Kansas City, which re-broadcast the instructions to the plane.

Besides a reliable transmitter, a modern transport carries a receiving set tuned to the wave length of the department of commerce beacons and broadcasts, a second receiver tuned for messages from the company's private stations, and an auxiliary receiver that can be tuned to receive from either wave length. Power for the sets can be taken from either of two groups of the plane's main batteries, from emergency dry cells, or from the plane's dynamotor.

Due to radio, bad weather is no longer the bugaboo of the airways. If a plane can't get through a storm it goes above or around it and keeps in constant touch with the ground. Weather that a few years ago would have grounded every plane is now conquered with safety. Planes are still held on the ground when "zero zero," no ceiling and no visibility, prevent their taking off, but in the air the main hazard left is ice. Forming on the hubs of the propellers and then building out along the blades, ice cuts down the lifting capacity of a plane. If the ice is thrown from one blade the motor must be throttled down to prevent too much vibration. When ice begins to form, pilots seek a higher altitude where the greater cold prevents its rapid accumulation, or go down to warmer altitudes where it will be melted.

To fly an airline passenger plane today, a pilot must pass the stiffest flying tests in the world. Flying by means of instruments in a hooded cockpit, he is required to maintain a straight compass course in a steep climb, make 180 and 360-degree turns without changing altitude, then resume his original course, make steep-banked turns in which the controls are reversed and in which his own propeller wash throws the plane around, and recover from spins and inverted flight. All this must be done without using the artificial horizon.

Finally the pilot is told the plane is lost in fog and he must locate a radio beam and guide himself to a field, placing himself in a position for a normal approach not more than 500 feet above the airport, entirely by radio. Even after he has qualified he must take frequent examinations.

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INGRAM'S SHAVING CREAM

When writing to advertisers please mention Popular Mechanics

Heroes of the Flying Cross

(Continued from page 570)

emergency 'chute, which checked my drop and I alighted in a field."

A gas bag that went wrong brought the Distinguished Flying Cross to three noted balloonists of the air corps. In July of last year Maj. William E. Kepner, Capt. Albert W. Stevens and Capt. Orvil A. Anderson attempted a flight into the stratosphere. Their metal gondola, filled with scientific instruments, was attached to a huge gas bag. During the flight, the balloon became disabled. Great rips ran down the side and at 10,000 feet the occupants were forced to "abandon ship." The portholes of the gondola were opened and Capt. Anderson was hurtled out of the great ball by a jerk. Kepner and Stevens still clung to it, hoping to release the huge parachute and ease it toward the ground with the instruments. For 5,000 feet they clung to this ball, fighting the weird aerial battle. At last they lost and were forced to jump to save their lives.

Does lightning ever strike a moving plane or 'chute in the sky? A balloon occupied by Lieut. Uzal G. Ent and Lieut. Paul Evart, pilot, was taking part in a race at Bettis Field, Pittsburgh. The balloon was at about 2,000 feet when a thunder shower came up. They fastened on their parachutes and descended below the storm level. After ascending again Lieut. Ent reported a loud explosion.

"My left leg and right arm were paralyzed temporarily by the shock," says Lieut. Ent. "I got to my feet but found the balloon was on fire at the top. Efforts to revive Evart were ineffective but I thought he was alive. My first thought was to throw him over the side and trip the parachute, but I considered this unwise owing to the type of the 'chute. I decided to jump, then changed my mind. The balloon was falling about 200 feet per minute, but accelerating. It was not possible to valve, due to the danger of an explosion. The maximum rate of fall was about 700 feet per minute. To check this, avoid landing near some village, and to try to land in some small creek, all available ballast was thrown. The balance of the gas burned at about fifteen feet. The basket landed on the bank of a stream with little jar. The burning bag fell away from

the basket. With the aid of bystanders Lieut. Evart's body was removed. Artificial respiration was tried but he was pronounced dead. Electrical shock was given as the cause of his death. In my opinion lightning did not strike the balloon. What I think happened was this. A heavy charge of static was responsible for his death and the subsequent fire, and this charge may have generated around the valve."

Piloting an amphibian across the Canal Zone, Lieut. Cornelius W. Cousland saw his co-pilot mortally wounded by a part of one of the ship's motors. The body of the dying man fell across Cousland's lap. Below lay Gatun Lake, studded with tree stumps. Behind was a cabin full of passengers. In front was a disabled engine. He rose to the situation, however. He fought the controls until his spinning ship was righted and then, by skilled maneuvering, brought it down on the lake beside the jungle among the rotting stumps.

Sergt. Neff of the air corps received the Cross for hand-cranking a motor of the dirigible TC-71 when all other means failed after the ship had been broken loose from its mooring by a storm. Neff discarded his parachute and, climbing out on the rigging, worked in the darkness and the lashing storm until he turned the motor over. His courage saved the ship and its crew from destruction.

The Flying Cross is given also for outstanding flights as well as heroic action in the air. It has been won likewise by heroes on the ground who, at the risk of their lives, have rushed up to crashed and burning planes and rescued the occupants.

STAR MUCH HOTTER THAN SUN IS MEASURED BY SCIENCE

With a surface temperature many times greater than that of the sun, a distant star has been found to have a heat of 180,000 degrees Fahrenheit. The sun's surface is about 10,000 degrees. This particular star is a sun surrounded by a nebula, which in the telescope looks like a halo. This nebula, according to Dr. I. S. Bowen of California Institute of Technology, enabled scientists to measure the temperature with the aid of the latest instruments.

Pasadena, Calif.

Temperature astronomer reading made by clutch

Newspaper Times 7/19/35



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No matter how skinny and run-down you may be from lack of enough Vitamin B and iron, this marvelous new Ironized Yeast should build you up in a few short weeks as it has thousands. If you are not delighted with the results of the very first package, your money will be instantly refunded.

Only don't be deceived by the many cheaply prepared "Yeast and Iron" tablets sold in imitation of Ironized Yeast. These cheap counterfeits usually contain only the lowest grade of ordinary yeast and iron, and cannot possibly give the same results as the scientific Ironized Yeast formula. Be sure you get genuine Ironized Yeast. Look for "IY" stamped on each tablet.

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Split-Second Photography

(Continued from page 555)

ufacture until the lags in the bulb action and shutter movement are timed so the shutter opens and shuts when the bulb is producing the most light.

The same thing is accomplished by the mechanical speed-flash gun in a different way. The shutter cable-release is removed and a spring-operated synchronizer, wound like a watch, is attached in its place. The cable is then screwed into a socket in the synchronizer. The attachment is a combination of electric switch and spring plunger. It is adjusted so that, after being wound up and released by pressure on the cable button, the switch first closes the photoflash lamp circuit, and then, at the proper instant, the plunger releases the shutter.

A hundred or more lamps can be arranged throughout a large auditorium, and flashed simultaneously, with the assurance that the camera will snap the picture while they are burning most brilliantly. One multiple synchronizing outfit fires 192 bulbs at once, requiring the flow for an instant of 576 amperes of current. This would wreck the average wiring system if the bulbs were fired directly from the 110-volt line. But, by feeding the current into the multiframe synchronizer, it is transformed into a high-ampere, low-voltage impulse that fires the lamps without danger of overheating the power wires.

Professional type photoflash synchronizers cost from \$12.50 to \$22.50. It is reported an amateur type synchronizer is to be marketed soon for about \$5.00. The ingenious amateur can construct his own synchronizer or semi-synchronizer. A simple one is illustrated. It is a hinged arrangement attached to the shutter release cable. When the leaves of the hinge are squeezed together, the cable button is pressed, opening the shutter, which has been set on bulb. Then, as the leaves move closer together, two electrical contacts close, firing the lamp.

Make the halves of the hinge from strips of aluminum or brass measuring about one-eighth by one-half by four and one-fourth inches. Rivet a small brass hinge about one-half inch long between the strips when they are placed end to end, with a gap of about three-sixteenths inch

between them. This forms the hinged joint. At the opposite end of one strip, drill a hole large enough to receive the metal collar attached to the outer end of the shutter cable. This collar is flared to provide a finger hold. Near the edge of the flared part when the cable is passed through the hole, drill another hole in the strip and thread it to receive a small bolt, whose head clamps the flared collar firmly.

Midway between the ends of the same strip drill a hole and tap it to receive a small bolt equipped with a lock nut. At a point directly opposite this hole, in the other strip, drill another hole, making it large enough to receive a bolt which has been passed through an insulating tube of hard rubber, paper or other non-conducting material. Use insulating washers beneath the bolt head and nut. This bolt must not come in contact with the rest of the synchronizer. File its head flat, to provide a good contact surface for the end of the bolt in the other strip.

Adjust the bolt with the lock nut until it touches the flat head of the insulated bolt immediately after the shutter has opened as a result of the cable button being pressed. Connect the synchronizer into the circuit in place of the usual switch on any standard photoflash gun, running one wire to the insulated bolt and the other to any convenient part of the strip containing the other bolt.

Set the shutter to the "B" or bulb mark—"D" on some foreign cameras. When the hinge is squeezed together, the cable-release plunger moves inward and opens the shutter. Then the two bolts come together, closing the electrical circuit and firing the lamp. Release the hinge immediately, to permit the shutter to close. It may be necessary to insert a spring that will force the hinge open, if the spring in the release cable is not strong enough.

Very short exposures can be given, the duration depending on the speed of the bulb, but the shutter will remain open no longer than necessary for making this exposure. The size can be altered to fit any shutter-release cable or trigger. Construction can be simplified by using maple or other hardwood for the two hinged

(Continued to page 125A)



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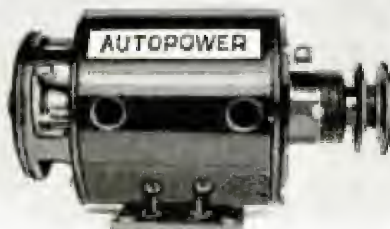


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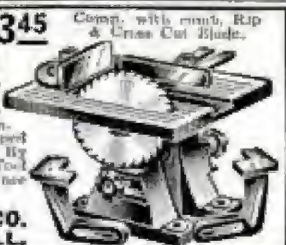
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SPLIT-SECOND PHOTOGRAPHY

(Continued from page 122A)

arms, and connecting the flexible wires directly to the two screws. Screw threads of sufficient strength can be cut in maple, for the adjustable contact. By careful adjustment, shutter speeds of one-half or one-fifth second can be employed. Be sure to fasten the hinge firmly and have the hinge pin working tightly, or the lost motion will make such speeds unreliable. Use it only with low-voltage battery circuits; never when the bulbs are fired by house-lighting current.

Camera shutters also may be synchronized with flashlight guns using magnesium powder. Usually the force of the powder explosion causes an arm to move and complete an electrical circuit which energizes a magnetic tripping device on the shutter. Such a magnetic attachment can be made from a doorbell or buzzer.

An English photographer uses synchronized photoflood lamps to photograph fish and animals. These lamps are simply low-voltage bulbs burned at a voltage that raises their tungsten filaments nearly to the melting point. Intense light caused the animals to move. He devised a system of relays so that, by closing a switch, the photoflood lamps would be illuminated and, as they reached full brilliancy, the shutter would operate. By using two doorbells as relays, he secured the necessary delay in shutter action.

Practically any amateur camera having a between-the-lens shutter is adaptable to photoflash equipment. Lenses of extreme speed are not necessary, because, with fast film, speed shots can be made at lens openings of f:8 (U. S. 4) or thereabouts. Shutter speeds of one-two-hundredth second will stop ordinary child action. Photographing sports activities at night is another fascinating field. The subjects of candid camera shots do not know they are being photographed until the bulb flashes; and with the blue lamps, even this warning is eliminated.

Split-second flash-bulb tactics sometimes produce unusual lighting effects in bright sunlight. The illumination from photoflash bulbs in reflectors is more intense than sunlight on subjects a few feet away. With photoflash bulbs, the cost per exposure may be a bit higher, but the results possible will offset the cost.

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Fitted into the cylinder-bore is a relatively simple looking assembly of piston, piston rings, piston pins, and the connecting-rod which is joined to the crank-shaft.

The primary service of the piston is to convert the pressure of the exploding gasoline on its upper, or closed face, into the force necessary for turning the crank-shaft. The downward escape of the gases is checked by the flexible rings and by the film of lubricating oil between piston and cylinder.

This oil film also must resist the terrific heat playing upon the piston as well as cushion the shock of the sidewise thrust of the downswinging piston and connecting-rod. Any weakness in the oil film inevitably leads to prematurely worn rings, scored cylinders, loose pistons. This condition in turn leads to rapid formation of carbon.

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IDEAL CO. 26 W. 19th, New York City

8569 EASY DOG STUNTS

(Continued from page 565)

arms grooved in this fashion. An old bicycle tire is best at first, but as soon as the dog learns to jump through without the guiding leash, a metal hoop can be substituted. Virtually all trainers teach dogs to do the "grapevine" through their legs with a leash and cane. As the dog walks through the trainer's legs, the trainer switches the cane and leash from one hand to the other, the former lightly tapping the rear end of the dog as the master says: "Now, left" and "Now, right." The leash is eliminated as soon as the dog gets the idea, then the cane is dropped, and finally, the commands are eliminated.

The hop over the stick can pave the way for training your dog to walk on his front legs. Touch him with the stick on the hind legs while he is making the hop. This causes him to hold his rear legs up as he takes a few steps with his front legs. The number of steps is increased after the first preliminaries until the dog gradually develops into a front-legged walker.

A dog will learn to walk on his hind legs if allowed to place his front paws on a stick that is moved slowly forward. If your dog likes to amuse himself with a rubber ball or stick and shows retrieving talent, he can be taught to get your cap or bedroom slippers, but this may take weeks or even months of daily work. As soon as the dog learns to retrieve a ball or stick, an old cap or a pair of slippers can be substituted. Once the dog learns to retrieve them, the distances can be lengthened to encompass the whole house. The words "cap" or "slippers" should send him scampering to where they have been left. All the while, however, the dog must be kept "sold" on the idea he is only playing.

One of the most difficult tricks is the somersault. To teach this trick, your dog should have a shoulder harness to which are attached two sturdy leashes by means of swivel snaps ringed where the breast straps cross the shoulder ones. A square board should be slanted against the baseboard. Place the dog on this board, grasp the leashes in either hand and slowly flip the animal over so he will light first on his hind legs and then on all fours. The board is gradually lowered and the training repeated until the dog engages in the somersault when he hears the signal.

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Less Motor

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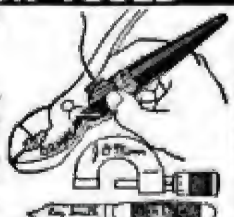
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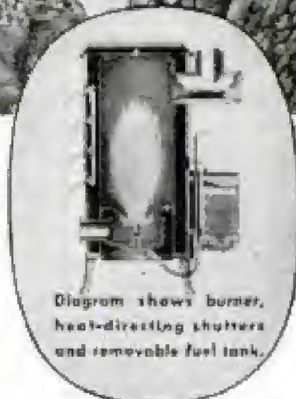
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The vaporizing burner uses inexpensive No. 1 fuel oil, kerosene or distillate. The removable fuel tank holds enough for as many as forty-two hours. The finish is porcelain enamel in rich burled walnut design. There are three sizes, also several radiating models.

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8 400

Air Masses Tell Future Weather

(Continued from page 500)

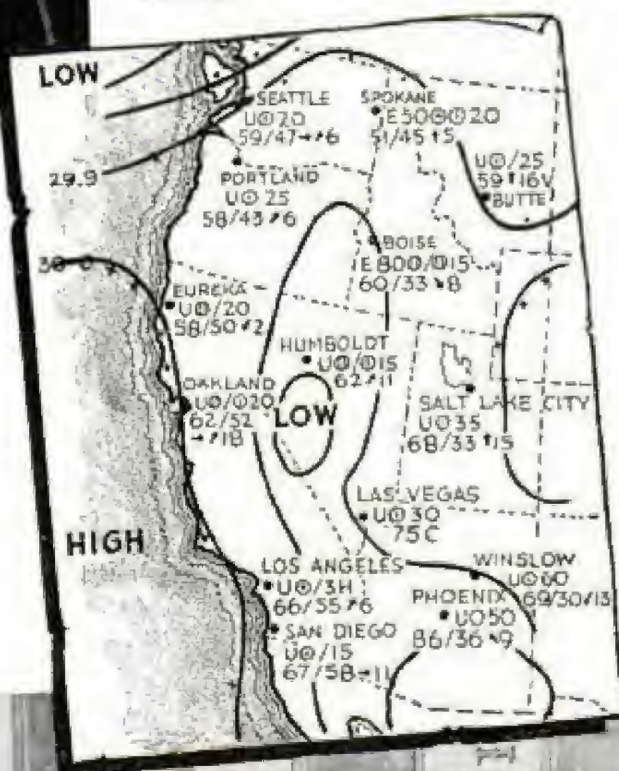


Top, Pilot Checks Weather Map of Route; Bottom, Plane Dispatcher Studies Air Conditions

finished, the forecaster can apply laws of physics and calculate the mass movements and resultant weather for hours ahead.

Suppose a warm-air mass is virtually motionless over one area. Rushing toward it is a cold-air mass. Knowing this, the forecaster can prophesy that much of the energy of the cold mass will be expended sideways because the heavier cold air cannot rise above the warmer body. Currents of cold air will run along the front of the warm mass, then, and set up a wave in it. This wave gradually assumes a circular motion which may develop into a tornado. Or perhaps the forecaster finds a situation foreboding squalls. A polar air mass is approaching. It is cold, but its lower level has been warmed moderately by contact with earth and sea, and it has also picked up considerable moisture. As it warms, this air rises and cold air descends to take its place. This is called "overtake" and brings nasty weather, with gusty winds and squalls. Overtake is also caused by the retarding of the lower part of the mass due to friction with the earth.

The air-mass analysis method is used chiefly by the air lines. In addition to long-range forecasts, pilots receive a weather report every fifteen minutes from the department of commerce. Specific forecasts thirty-two hours in advance and general forecasts for forty-eight hours are being made by air-line experts. Eventually meteorologists hope to make accurate general forecasts as far ahead as seventy-two hours.

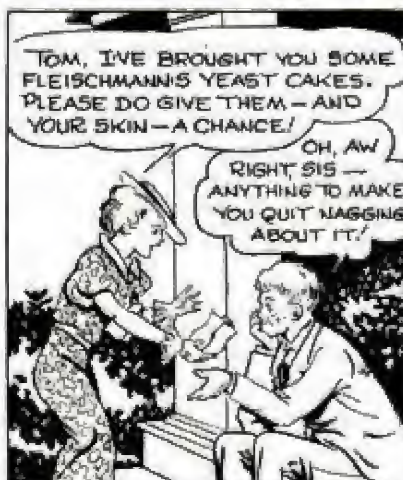


Map Symbols, Phoenix, Read "Ceiling Unlimited, Clear, Visibility 50 Miles, Temperature 86, Dew Point 36, Nine-Mile Southeast Wind"

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**But soon
... they
changed
this ugly
nickname**



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Between the ages of 13 and 25, important glands develop. This causes disturbances throughout the body. Waste poisons get into the blood and irritate the skin, making it break out in pimples.

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—clears the skin
by clearing skin irritants
out of the blood

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THE LATEST FOR THE CRAFTSMAN

(Continued from Coloroto Section)

rating take only a few minutes. The same basket made of wood involves sawing, grooving, sanding, gluing, applying a finish molding, filling and several coats of paint.

A simple piece like the metal basket can be completed in less than half an hour at a total cost of less than twenty cents, including the paint and wire. Other pieces, and there are hundreds from which to select, are comparably inexpensive. The four units occupy only a few square feet of floor space and none of them involves dirt, danger or any great amount of noise.

Besides the four units the home craftsman needs a bench, a vise, an electric soldering iron for delicate work, a hack saw, tinners' snips, drills, files, punches and a few other tools. He can start with the welder and metal former and add the other two units later. The welder, shaper and hand tools can be obtained for less than \$100, or a complete outfit with accessories for the units can be purchased for less than \$250.

Working up a paying business from this hobby is a simple matter since the line of articles which can be made is limited only by the ingenuity of the craftsman. Besides those already named, a list might include such diversified items as tool boxes, display racks for stores, signs and brackets, trash burners, various kinds of light furniture, milking stools, souvenirs and novelties, models, children's toys, insulated milk boxes, incubators, dog houses, window refrigerators, mail boxes, hog troughs, clothes driers, magazine racks and countless dozens of others, each representing an article of real monetary value.

Books of designs and patterns and all necessary materials are supplied by the makers of the metal working equipment, or can be obtained locally, hence the most remote home craftsman has the same opportunity to convert his shop into a factory without a smokestack as is offered to his city brother.

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E 647

EXPLOSION EXPERTS

(Continued from page 533)



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screened, and all hard objects removed. The gravestones were constructed of pressed cork coated with plaster of paris. But Hoffman had to blow up sixty caskets before the right effect was achieved.

Fred Davis, powder man for Warner Brothers First National, proudly displayed an assorted collection of medical cartons.

"We buy these in all sizes and use them for making bombs," Davis explained. "We insert a couple of wires, pour in powder, put on the lids, then wrap the carton with paper adhesive tape and coat it with shellac. By using different sizes and varying the thickness of the taping a wide variety of charges may be obtained. We also make very small bombs from capsules like the druggist uses for quinine. These little bombs are used for rifle effects and for explosions on miniature sets.

"Such things are really quite simple," Davis says. "It is the scene where bullets are made to ricochet that is difficult."

In the case of a deflected bullet accuracy alone is not sufficient. In addition to hitting the mark the angle of fire must be figured so the slug will be deflected away from the actor. In "G-Men" Cagney was behind a woodpile when the studio sharpshooters opened up with machine guns and piled kindling all about him. This business of shooting to miss is nerve racking but if you're good it pays \$100 a day.

Powder experts claim live ammunition in the hands of expert marksmen is safer than blanks shot by inexperienced extras. A charge from a blank is exceedingly dangerous within fifteen feet. If received in a soft portion of the body, it will penetrate deeply and might be fatal, so for close work the blanks are reloaded with half charges, the wad removed, and a capsule substituted. On firing, the capsule melts, making such a shot harmless even at close range, but the noise of discharge is not loud enough so the sound is dubbed in. Most of the blanks are loaded at the studio gunnery to meet definite requirements. For night shooting, blanks are made with flash powder to make the shots show well. The cost of blank ammunition is one of the major items of production, for the average western picture uses from \$600 to \$700 worth of blanks, and a good war scene runs from \$2,000 to \$7,000.

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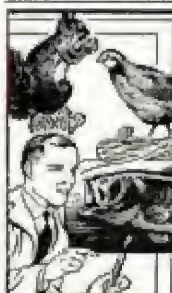
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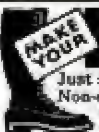


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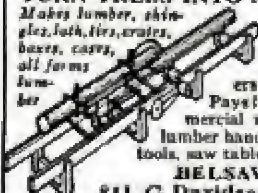


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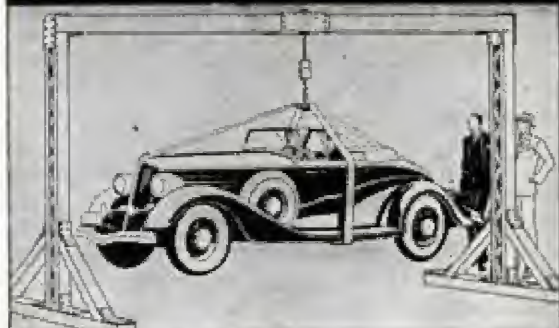
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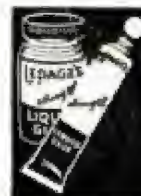


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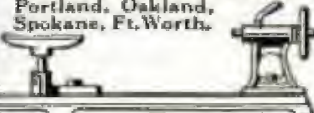
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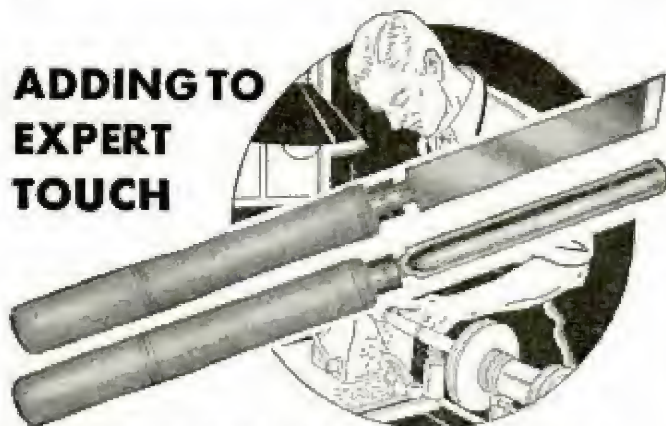
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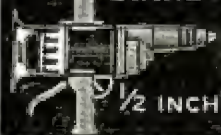
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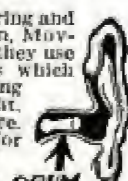
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A. O. LEONARD, Inc., Suite 699, 70 5th Ave., New York

TELEVISION ON TRIAL

(Continued from page 526)

to receive either on 240 or 405 lines. The transmission is on the wave band between six and seven meters.

In order that the public and unbiased engineers may decide the merits of 240 and 405-line transmission, the committee has decided to have alternate broadcasts of the two definitions. One day, transmission will be on 240 lines, and the next day on 405 lines. The transmitters are under the same roof at Alexandra Palace, and their building was financed by the radio license fees paid by radio fans.

It costs about \$2.50 to license a home radio set in the British Isles. This fee may be increased as television develops. For the time being, a television receiver may be installed in the home without additional cost. The high-definition service in England makes it possible for fans to receive pictures that are as clear and contrasting as the best printed pictures. The picture size is now about twelve inches square, but it is easily possible to enlarge this with a magnifying glass.

The quality of reception on one of the old television receivers is equivalent to the moving-picture definition in the year 1910. This transmission is only thirty lines, of course, and by comparison with 240 lines or 405 lines it is quite crude. But even about the crude television transmission there are some remarkable features. First of all, the television camera, like the movie camera, gives an excellent idea of perspective. But it goes even beyond the movie camera when it comes to giving an object relief, or a third dimension. A face does not appear flat, but one actually sees its spherical contour. The television performers make up quite elaborately. They paint their faces a ghastly white, using black lines for wrinkles. But with 240 or 405-line transmission very little make-up is necessary, and their faces appear quite natural.

And the sound part of television broadcasting is as successful as sound with moving pictures has been.

Names and addresses of manufacturers and dealers in articles described in this magazine will be furnished by our Bureau of Information upon request accompanied by stamped, self-addressed envelope.

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—Wayne J. Hatchett
Engineer, WNAX

"I am in complete charge of television here and have designed and supervised construction of all television apparatus."—M. E. Eisenberg, in charge of Television Development at WDGY (also television station W9XAT), Minneapolis, Minnesota.



"Take it away,"—
Student engineers flash actual broadcast on air.



S. Q. Noel, President
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STEAM STILL RULES THE RAILS

6792 (Continued from page 513)

A brakeman in the beaver-tailed rear parlor car pulls a cord signaling with a high, piping whistle in the cab of the engine for a test of brakes. Bill gives the automatic a turn. All's right. Then he tries the secondary brake, which applies to the locomotive wheels alone. This brake is used only in yard operations or to hold a train stationary at the station.

"Clear at the cylinder cocks?" Bill calls across the cab to Ed. The fireman nods, with a sly wink. Bill pulls a lever, and steam shoots out in a horizontal jet from each cylinder, narrowly missing a yardman walking alongside. He shakes a fist at the fireman and grins. These cylinder cocks must be blown at the start because of condensation in the cold cylinders.

The steam locomotive always has had speed to spare. As early as 1897 the Atlantic City express of the Reading road was running from Camden to Atlantic City, fifty-five and one-half miles, at a scheduled speed from start to stop of about seventy miles per hour.

Today the challenge of Diesel and electric-power and lightweight trains has caused the steam locomotive to use some of its reserve speed and it is matching schedules with the best the Diesels can do. The "Hiawatha," the oil-burning and steam-powered "400" of the North Western, and the Burlington's Diesel-powered lightweight "Twin Zephyrs" all have the same station-to-station time between Chicago and St. Paul.

The Burlington's Diesel-driven "Zephyr" running between Kansas City and Lincoln makes the 251 miles at an average speed, start to stop, of 45.6 miles per hour, but the steam-powered "Yankee Clipper" of the New Haven road goes from New York to Boston, 229 miles, at an average of 50.9 miles per hour, start to stop. And the Baltimore and Ohio's steam-powered "Columbian" travels from New York to Washington, 223.6 miles, at an average of 55.9 miles per hour, station to station.

All of which leads the champions of steam to proclaim that there is no more likelihood of the railroads becoming Dieselized than there was a few years ago of becoming electrified overnight. The steam locomotive, claim its defenders, is too fast and powerful to lie down and play dead.

AGENTS!!

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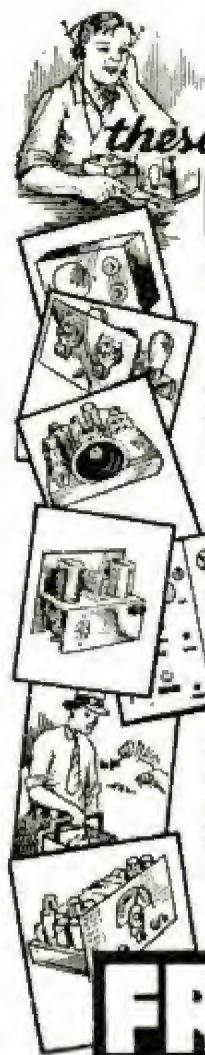
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S.-W. SUPER HAS CRYSTAL FILTER

(Continued from page 581)

and forth through resonance, thereby becoming of great advantage in completely eliminating interference from near-by stations which are beating with the signal being tuned.

When the desired station has been tuned in accurately with the main tuning controls of the receiver, and interference prevents good reception, the filter condenser is rotated until a certain sharp point of adjustment is located where the interfering signal drops out.

HOW TO INSTALL A GOOD ANTENNA

(Continued from page 584)

the 500 to 1,500-kilocycle band the handles should be thrown down to the B-B position. This setting is also satisfactory for ordinary short-wave reception. If the short-wave signals do not come in with sufficient strength, the switches are set at the I-B position for frequencies between 1,500 and 6,000 kilocycles; the I-S position is employed for frequencies between 6,000 and 15,000 kilocycles.

This same system may be used as a double doublet by merely connecting the transmission line to the center of the antenna arrangement shown in Fig. 11. In this case the antenna coupler is not used. The receiver transformer should be operated with the switches in the position I-B and the receiver should not be grounded. This system is recommended when a short-wave receiver is to be used or when greater efficiency is desired in the short-wave bands than in the broadcast band. A chart, furnished with the kit, shows suggested lengths for the flat-top sections "A" and "B," with the wavelengths at which the highest efficiency will be obtained.

When erecting an antenna, select the type best suited for your particular location and the kind of service desired. Remember that it should be kept as high above the ground and as far from all other wires as possible. In all cases the antenna should run at right angles to telephone, electric-light or trolley wires. If there are any points not clear to the reader, or further data are desired on the various systems described, this information can be obtained from Popular Mechanics radio department, without charge.

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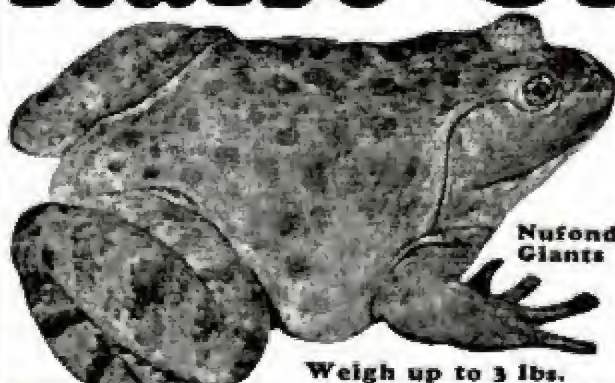
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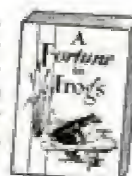
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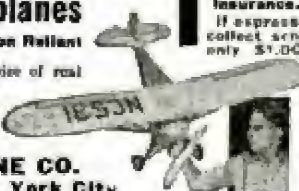
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COPPER-OXIDE RECTIFIERS

(Continued from page 583)

quired, also 5 copper terminal strips and 2 end plates cut from 1/8-in. bakelite, as detailed in Fig. 5. Sixteen-gauge sheet copper is used for the copper washers and terminal strips. The lead washers are cut from 1/8-in. lead sheet. All washers are outlined on the sheet metal and the center holes drilled, after which they are cut out with a pair of heavy tin snips. Two 1/4-in. bolts 4 in. long, and two lengths of fiber tubing 3/8 in. outside diameter and 1 1/2 in. long, are also included in the material list.

Be sure that the copper washers are perfectly flat, file off all rough edges and ream out the holes so that they will fit over the fiber tubing. The next step is to form the layer of copper oxide on one side of the copper washers. Place them, one at a time, on the end of a long nail or bolt and hold them over the flame of a bunsen burner, gas torch or gas stove. When the washer reaches a bright cherry red, remove it from the flame and hang it on a nail to cool, as shown in the photo. Make sure that there is a free circulation of air around it. Sixteen nails driven in a board will make a good rack for this purpose.

When cold, you will find that a blue-gray scale has formed on the surface which must be removed carefully from the face side only, with a piece of fine emery cloth. Handle these washers only by the edge. Lay them on a flat surface and do not press hard with the emery cloth as it will cut through the brownish-red copper-oxide deposit below and destroy its rectifying usefulness.

To make the final assembly, Fig. 6, ream the holes in the bakelite end plates, and copper-terminal strips, to pass the fiber tubing snugly. Insert the bolts and assemble the washers and terminal strips, being very careful that the copper-oxide faces are placed exactly as shown in Fig. 6, and keyed in Figs. 6-A and 6-B. Turn the end nuts down as tightly as possible and fasten the copper-strip terminal jumper as shown.

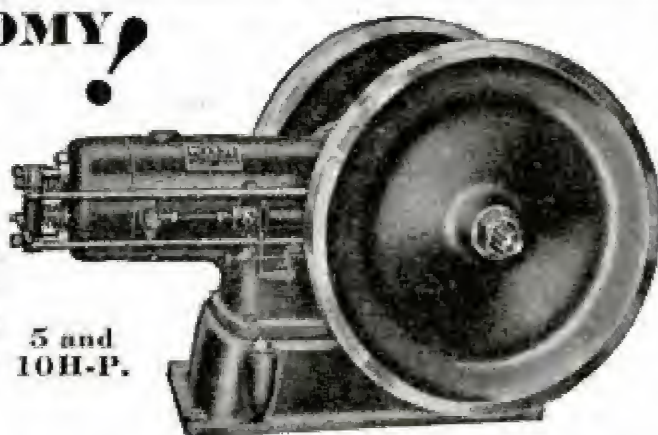
An enlarged blueprint of all diagrams is available, those who wish it should specify blueprint R-214. The rectifier unit requires no further forming; however, the output current may go up a little as it is used for the first few hours. A battery-charger assembly is shown below Fig. 6.

4/28/34

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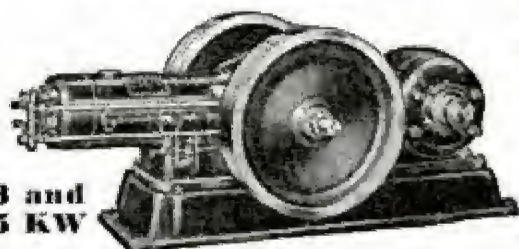


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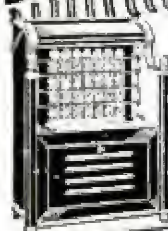
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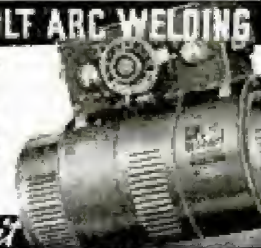
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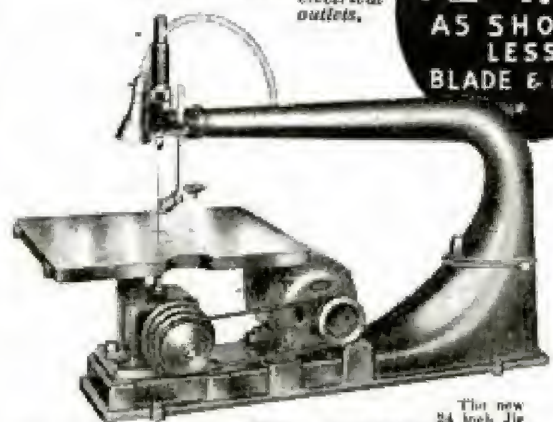
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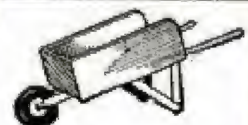
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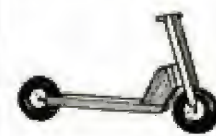
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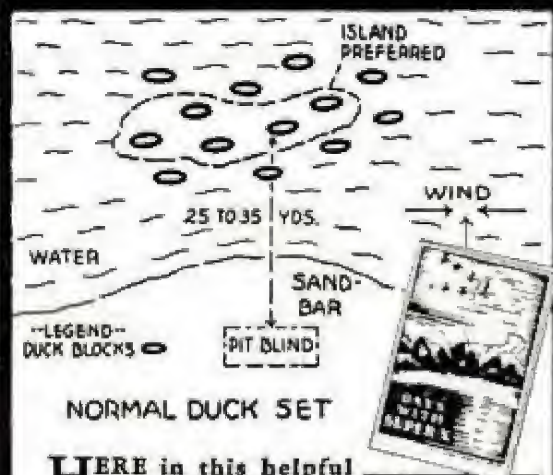
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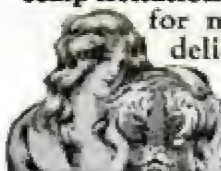
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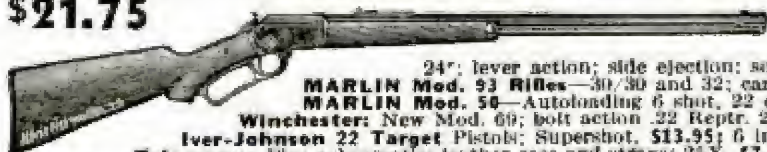
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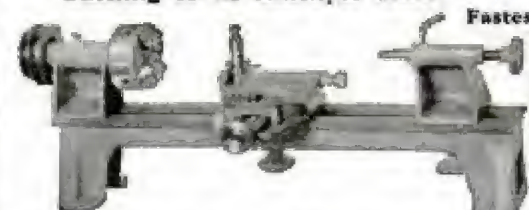
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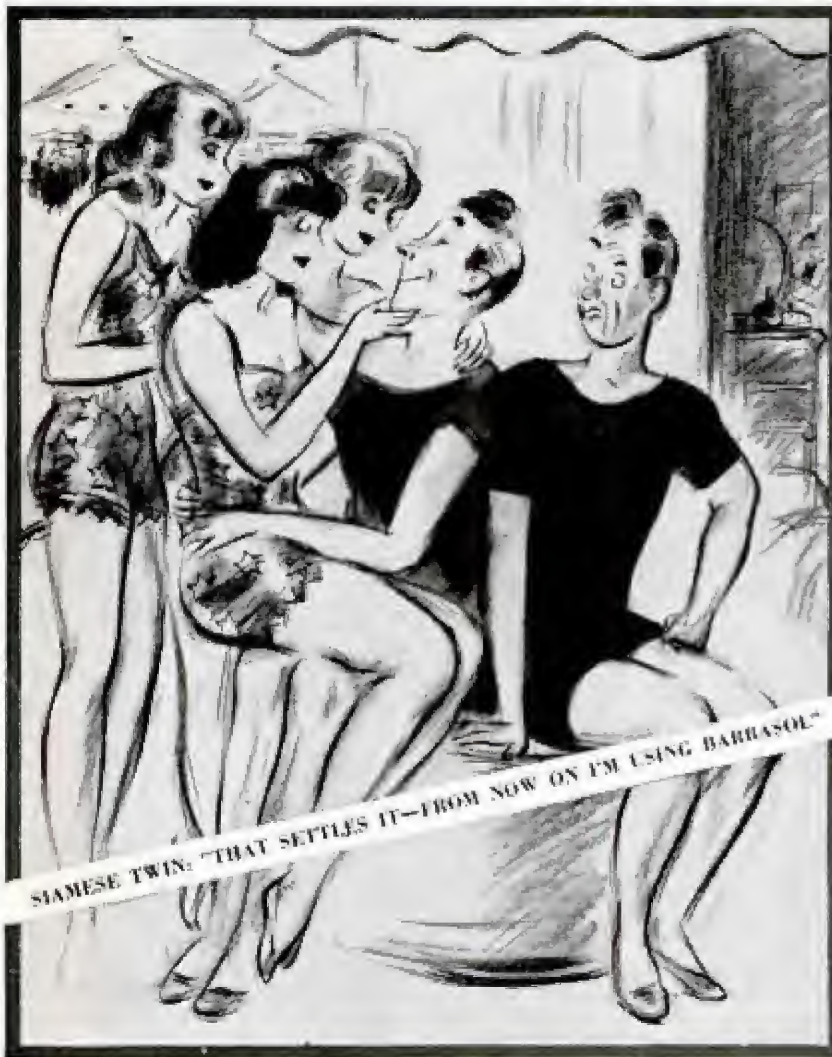
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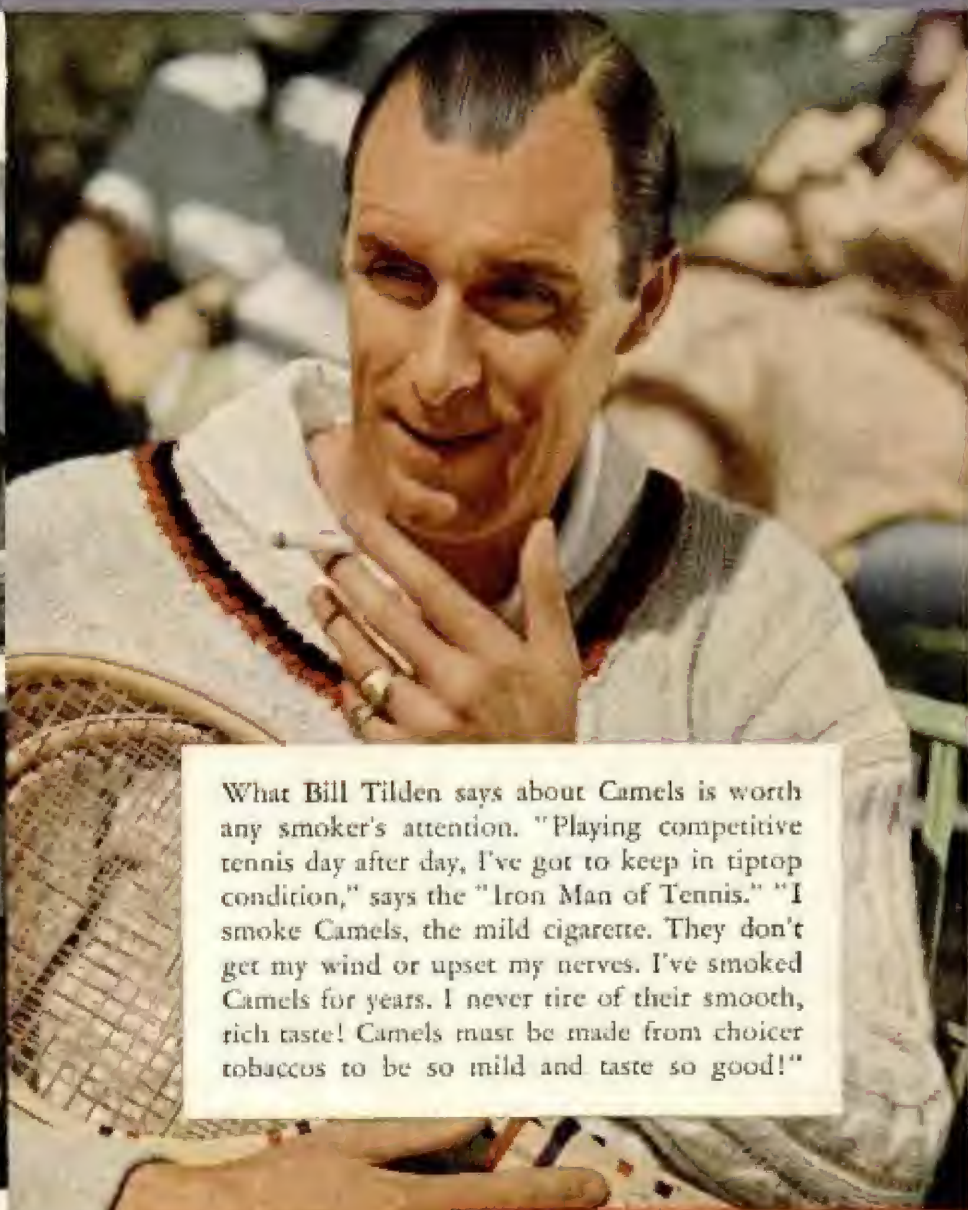
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AND NO MATTER HOW
MANY I SMOKE, THEY
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WRITER—Eileen Tighe



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